Chapter 3: Designated Use Assessment

Section 3.1: River and Stream Designated Use Assessment

Section 3.1a: River and Stream Aquatic Life Use Assessment

Aquatic life designated use support assessments evaluate attainment of Federal and State Surface Water Quality Standards provisions for the protection and propagation of a balanced population of shellfish, fish and wildlife.

The NJDEP has a wide range of data available including chemical, habitat, and biological information for assessing aquatic life use support. USEPA guidance for the Preparation of Water Quality Inventory Reports strongly emphasizes the use of biological data as the basis for assessing wade-able streams and rivers especially when the data quality is high, as in New Jersey. Therefore, NJDEP evaluated aquatic life designated use support in non-tidal rivers and streams using benthic macroinvertebrate monitoring. Descriptions of the macroinvertebrate monitoring program are in the Methods Document in Appendix II, Data Sources for the 2002 New Jersey Integrated Report. The methods used to assess the resulting data are contained in section 5.1.2 in the Methods Document.

Currently in New Jersey, monitoring occurs in the Ambient Biological Monitoring Network (AMNET) at over 800 locations statewide on a 5-year rotating schedule. Round 1 sampling was completed in the mid-1990's and the resulting designated use assessment results were reported in the 1992, 1994, 1996 and 1998 305(b) Reports. Round 2 sampling began in 1997 and was completed in 2001, the results of which form the basis for the assessment presented in this 2002 Integrated Report. Readers are referred to the 1996 or 1998 305(b) Reports (NJDEP, 1996; NJDEP, 1998) for the status of statewide aquatic life assessment results based upon the first round of sampling. These reports are available at http://www.state.nj.us/dep/watershedmgt/bfbm/downloads.html. Supplementing the Department's own biological monitoring are 26 benthic macroinvertebrate sites monitored by Monmouth County which had met the Department's QA/QC requirements for biological monitoring and assessments.

In addition to direct biological assessments, the current round of field work by the Department includes a qualitative assessment of stream habitat quality at each monitoring location, the results of which are used to compute a Habitat Assessment Score. Various components of the habitat are examined such as the amount of available cover along the stream bottom, amount of sediment deposition, bank stability, frequency of riffles, presence and amount of riparian vegetative cover, etc.

River and Stream Aquatic Life Use Assessment Results

A total of 921 benthic sites (AMNET and Monmouth County) were monitored in support of the this assessment. A subtotal of 348 benthic sites (38% of the total) were placed on Sublist 3 based upon protocols developed by an Interagency Workgroup comprised of representatives of NJDEP, USGS, and USEPA Region II. The protocols and technical basis supporting them are presented in Appendix IV of the Methods Document.

Out of the remaining 573 stations sampled by the NJDEP and Monmouth County: 223 stations (24% of the 921 sites) were rated as non-impaired and listed on sublist 1, 319 stations (35%) were rated as in nonsupport of the designated use and assigned to sublist 5. Of the total on sublist 5; 76 stations were assessed as severely impaired and 243 were assessed as moderately impaired. (see Table 3.1a-1). Thirty-one sites (3% of the total sites monitored) were found to be located below the head of tide and are unassessed. When translated into river miles the results are as follows: of a total of 2,462 miles assessed; 685 miles (28%) fully support the use (sublist 1), 957 miles (39%) represent insufficient data (sublist 3) and 820 miles (33%) do not support the use (sublist 5) (Table 3.1a-1).

Table 3.1a-1: Results of 2002 Integrated Assessment of Ambient Biological Monitoring Network

Assessment Category	Number of Sites	Equivalent River Miles	
		Monitored	**Estimated**
Full Support	223 (24 % of all 921 sites monitored)	641 (27%)	44 (34%)
Insufficient Data	348 (38 % of all 921 sites monitored)	957 (41 %)	0
Non Support	319***** (35 % of all 921 sites monitored)	736 (31 %)	84 (66%)
Unassessed**	31 (3% of all 921 sites monitored)		
Total Sites Assessed	921	2,334	128

***** Of this total; 243 sites are assessed as moderately impaired and 76 are severely impaired.

** This category represents sited located below head of tide.

Comparison with AMNET Results from the early 1990's

Evaluating the second round data against the first round assessments would be difficult due the large number of sites which have been assigned to Sublist 3 (insufficient data) in the 2002 Integrated List. In a sense, the 1998 network and the current network, as assessed here, are very different monitoring networks. The best comparison would be to enumerate the number of sites listed in the New Jersey 1998 303(d) list which have been delisted and moved to Sublist 1 (sites now in full attainment). Of a total of 590 AMNET sites originally listed in 1998, sixty-nine were assessed in 2002 as fully supporting the use and delisted (moved to Sublist 1) (see Table 3.1a-2). Two hundred and fifty-six sites are still assessed as being in non-support and remain on Sublist 5 of the 2002 List.

Of significance are 235 sites present on the 1998 List assessed in 2002 as being in need of additional evaluation (Sublist 3) due to their locations in relation to the Pinelands or headwater locations, etc. These sites are delisted from Sublist 5 (the 303(d) list and will need to be reassessed using methods calibrated for the special conditions represented by these locations. Also, twenty-six sites listed on the 1998 List were found to be located at or beyond the head of tide and are not assessed in 2002 as the current assessment methods are inappropriate for tidal conditions. These locations are also delisted from 303(d) (Sublist 5) and are regarded as

"unassessed." Four sites from the 1998 List could not be located in the AMNET database and are believed to represent transcription errors in the 1998 List.

Table 3.1a-2: 2002 Assessment Status of Sites Previously Listed on NJ's 1998 303(d) List

Assessment Category in 2002	Number of Sites from the 1998 303(d) List
Full Support	69
Insufficient Data	235
Non Support	256
Not Assessed: Tidal Sites	26
Not Assessed*	4
Total Assessed	590

* Sites which could not be located in the AMNET database and are believed to represent transcription errors in the 1998 List.

Other Indicators of Aquatic Life Use Attainment

As discussed in Chapter 2, dissolved oxygen (DO) and unionized ammonia are relevant to aquatic life uses: DO is required for most forms of aquatic life and unionized ammonia is toxic to aquatic life in elevated concentrations. Based on data collected between 1996 and 2000 in the Ambient Stream Monitoring Network (ASMN), with few exceptions, monitored rivers attain these SWQS criteria or have water quality better than required by the SWQS.

Source and Cause Assessment

Extensive research has pointed to four general factors which have been associated with the impairment of benthic communities. These factors are-

- habitat alterations (e.g., erosion, sedimentation),
- flow alterations (decreasing base flow, flashiness),
- natural factors (drought, population fluctuations), and
- water and sediment quality degradation.

Often, multiple factors play a role in observed impairments such as multiple ongoing anthropogenic activities in concert with residual contamination from historical point and/ or non-point sources.

Using NJDEP data collected at over 700 sites, USGS evaluated the relationships between watershed characteristics and benthic status (USGS, 1998) and found the following:

- the total area of forest and wetlands in a basin were the best predictor of an unimpaired benthic community
- the amount of urban land in close proximity to a sampling site was the best predictor of an impaired benthic community
- distance from pollution sources to sampling sites was significant.

Through the Long Island - New Jersey National Ambient Water Quality Assessment (LI-NJ NAWQA) program, extensive data collection was conducted at 36 sites, primarily in the Piedmont region of New Jersey (Kennen, 1999). Concentrations of conventionals, volatile organic contaminants, pesticides in water and sediment, fish, algae and benthic populations, habitat quality data were collected. Advanced multi-variate statistics were used to identify

factors that may contribute to benthic impairment. Results indicate that hydrologic instability (high and frequent peak flows and low base flows), substrate quality (low percent cobble in the substrate), the density and percent of impervious surface cover in the upstream watershed and total annual flow of municipal effluent were important factors that contribute to benthic impairment.

Figure 3.1a-1. Assessment Status of Stations for Aquatic Life.

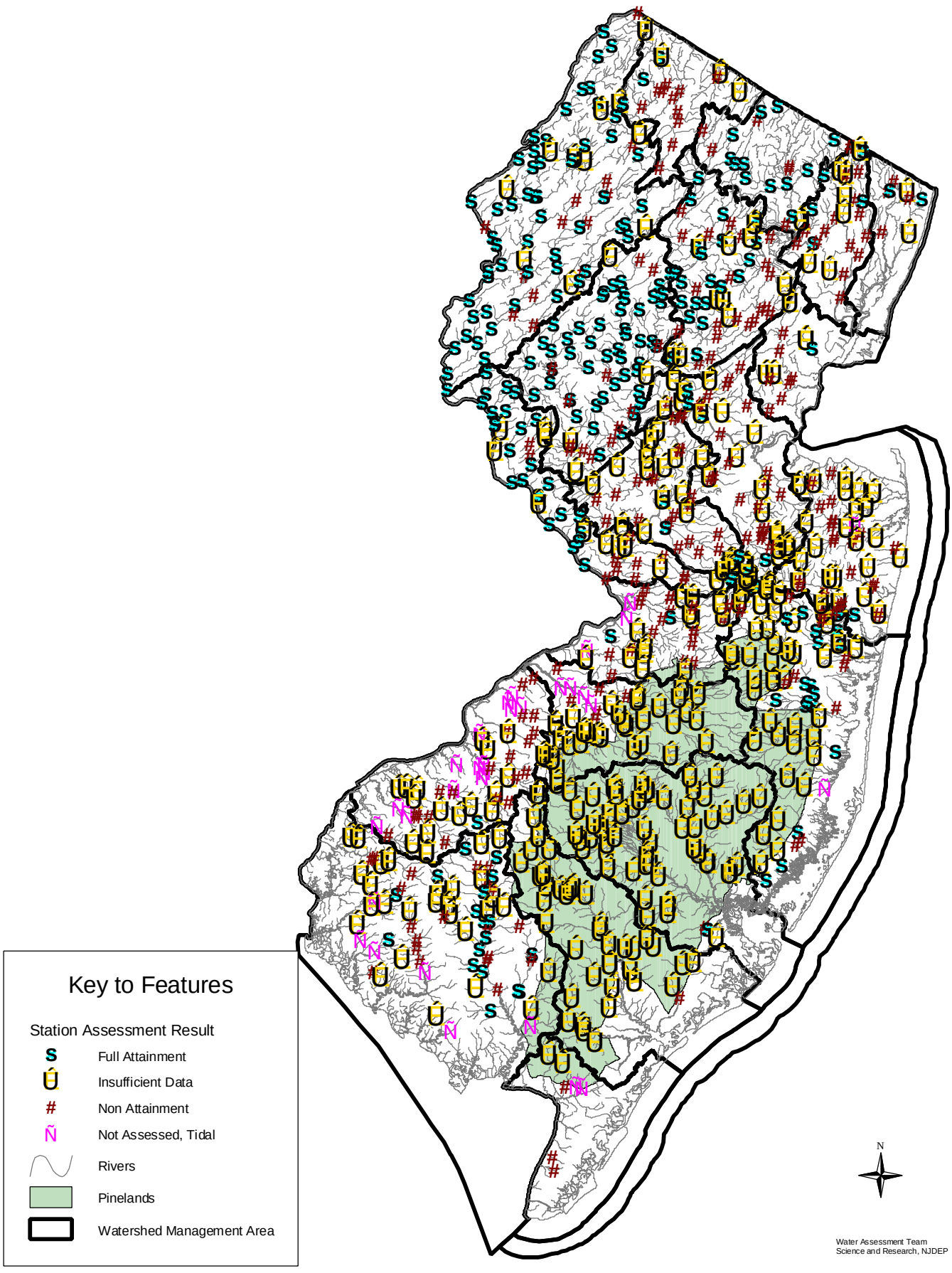
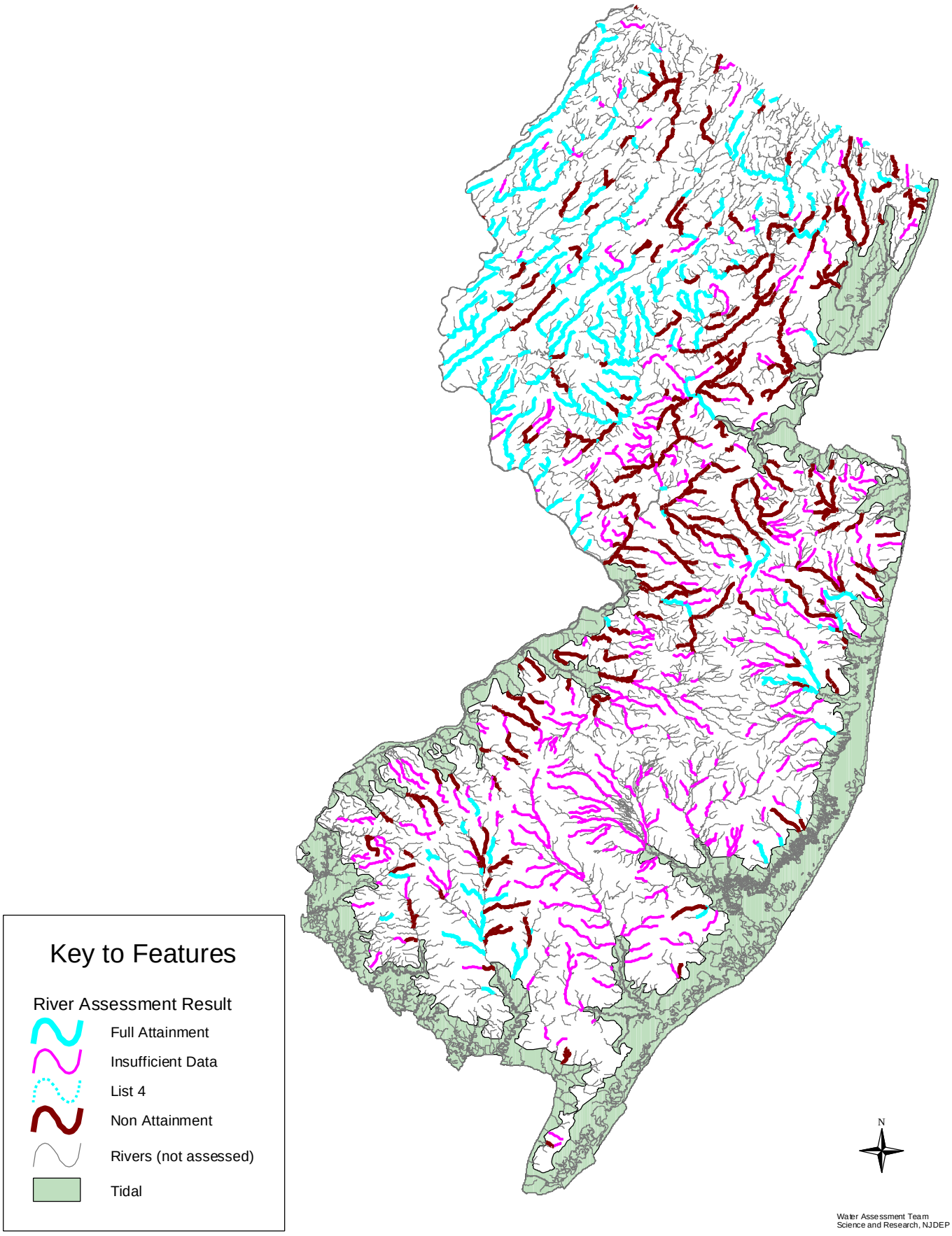


Figure 3.1a-2. Aquatic Life Assessment Status for River Segments. Includes monitored and estimated rivers.



Section 3.1b Rivers and Streams Recreational Designated Use Assessment

All waters in New Jersey are designated for primary contact recreation (i.e., swimming) and secondary contact recreation (e.g., wading, boating). In order to protect human health, fecal coliform bacteria criteria were established in New Jersey Surface Water Quality Standards (SWQS). Fecal coliform bacteria levels in water provide an indication of pollution from human or animal fecal material, which may contain organisms that are harmful to human health.

Some of New Jersey's rivers and streams, particularly those in the Pinelands, are used for swimming and secondary contact recreational activities, such as canoeing. Other rivers are not accessible or safe for these activities (e.g., steep banks, rapids, and private property). This assessment considers sanitary quality of rivers, and does not consider recreational beach amenities or access to the stream.

Rivers and Streams Recreational Designated Use Assessment

Approximately 2,063 miles of rivers represented by 271 monitoring stations were assessed for recreational designated use attainment. Only 22% of the assessed sites were fully attaining and 78% did not meet the standards for recreational activity when excluding Sub-list 3 sites with insufficient data. The median fecal coliform geometric mean for all of the sites was 399 MPN/100 ml. Two sites on the Whippany River were listed on Sub-list 4 for a completed TMDL although standards continue to be exceeded at the sites.

The assessment results for fecal coliform show that concentrations exceeded standards throughout the state. Impaired sites listed may be found in urban, agricultural, and forested areas. The only region in the state without widespread impairments was the Pinelands. However, even these waterways had impairments such as along Hospitality Branch, Hammonton Creek, and the lower stretch of the Great Egg Harbor River.

Results are summarized in Table 3.1b-1 below and provided for individual stations in Figure 3.1b-1-and Table II-9 and Table II-14 in the Appendix. Table 3.1b-2 summarizes the stations that meet the recreational designated use standards.

Table 3.1b-1: Fecal Coliform Attainment Status

FC Status	Number of Stations	Percent of Stations	Number of Assessed River Miles		Percent of Assessed River Miles	
			Monitor	Estimate	Monitor	Estimate
Sub-List 1	55	20%	297	132	18%	30%
Sub-List 3	17	6%	55	1	3%	>1%
Sub-List 4	2	1%	6	0	>1%	0%
Sub-List 5	197	73%	1257	315	79%	70%
Totals	271	100%	1615	448	100%	100%

Table 3.1b-2: Fecal Coliform Stations Meeting SWQS

WMA	Station Number	Station Name	Number of Samples	Percent Exceedance	Geomean
06	01378780	Primrose Brook at Morristown National Park	15	6.7%	103.1
06	01380500	Rockaway River at Boonton	13	7.7%	121.6
03	01381050	Crooked Brook near Towaco	5	0.0%	44.1
03	01382410	Macopin River at Echo Lake	8	0.0%	12.0
03	01383505	Wanaque River near Awosting	4	0.0%	22.1
03	01387010	Wanaque River at Highland Av at Wanaque	5	0.0%	82.8
04	01388500	Pompton River at Pompton Plains	8	0.0%	126.8
17	01400585	Rocky Brook at Perrineville	10	0.0%	71.8
09	01405302	Matchaponix Brook at Spotswood	14	7.1%	45.1
12	01407720	Jumping Brook at Green Grove	5	0.0%	183.8
13	01408480	Shannoc Brook Trib at Colliers Mills	5	0.0%	38.4
13	01408830	Cedar Brook at Cedar Crest	13	0.0%	14.8
13	01409050	NB Forked River near Forked River	6	0.0%	33.0
14	01409387	Mullica River at Outlet of Atsion Lake at Atsion	10	0.0%	18.4
14	01409408	Pump Branch near Waterford Works	5	0.0%	13.2
14	0140940950	Blue Anchor Brook at Elm	15	0.0%	14.0
14	0140941070	Great Swamp Branch below Rt 206 near Hammonton	5	0.0%	38.3
14	01409500	Batsto River at Batsto	10	0.0%	17.9
14	01409815	WB Wading River at Maxwell	10	0.0%	35.5
14	01409960	Papoose Branch near Sim Place	5	0.0%	22.2
14	01410000	Oswego River at Harrisville	4	0.0%	10.0
14	01410150	EB Bass River near New Gretna	10	0.0%	22.5
14	01410455	SB Absecon Creek near Pomona	5	0.0%	26.0
15	01410784	Great Egg Harbor River near Sicklerville	13	7.7%	18.9
5	01411000	Great Egg Harbor River at Folsom	14	0.0%	15.1
15	01411050	Hospitality Branch near Cecil	5	0.0%	57.9
15	01411196	Babcock Creek near Mays Landing	10	0.0%	104.1
15	01411220	South River near Belcoville	5	0.0%	114.6
15	01411241	Gibson Creek at Rt 50 near Corbin City	5	0.0%	27.0
17	01411453	Still Run near Malaga	5	0.0%	67.2
17	01411955	Gravelly Run at Laurel Lake	14	0.0%	40.0
17	01412200	Pages Run at Newport	4	0.0%	48.4
17	01413065	Canton Drain at Maskell Mill	5	0.0%	10.0
01	01439830	Big Flat Brook at Tuttles Corner	5	0.0%	20.9
01	01442760	Dunnfield Creek at Dunnfield	15	0.0%	9.9
01	01445000	Pequest River at Huntsville	4	0.0%	186.9
11	01463620	Assunpink Creek near Clarksville	14	7.1%	57.0
20	01464420	Crosswicks Creek near New Egypt	10	10.0%	132.1
20	01464440	Lahaway Creek at Rt 537 at Mercerville	5	0.0%	17.4
19	01465850	SB Rancocas Creek at Vincentown	14	7.1%	30.1
19	01465893	Little Creek at Chairville	10	10.0%	91.8
19	01466500	McDonalds Branch in Lebanon State Forest	10	0.0%	15.5
19	01467000	NB Rancocas Creek at Pemberton	13	7.7%	8.4
18	01467325	SB Big Timber Creek at Turnersville	5	0.0%	51.2

A total of 97 sites were listed on the 1998 303(d) List for fecal coliform exceedances. Of these sites, only 9 sites were de-listed after assessments of more current data showed conditions were now meeting fecal coliform standards (Table 3.1b-4). The remaining 88 sites were either carried over to Sub-list 5 on the 2002 Integrated List (Table 3.1b-3) or re-evaluated and determined as still not meeting the SWQS for fecal coliform.

Table 3.1b-3: Fecal Coliform Stations Carried Over From 1998 303(d) List

WMA	Station Number	Station Name
02	01367700	Wallkill River at Franklin
05	01378500	Hackensack River at New Milford
03	01387000	Wanaque River at Wanaque
06	01389130	Passaic River at Sigac
04	01391200	Saddle River At Fairlawn
08	01399200	Lamington River near Ironia
10	01401440	Millstone River at Kingston
10	01402540	Millstone River at Weston
09	01405400	Manalapan Brook near Spotswood
12	01407750	Shark River near Neptune City
12	01407760	Jumping Brook near Neptune City
01	01455500	Musconetcong River at Lake Hopatcong
01	01455801	Musconetcog River at Lockwood
11	01461300	Wickecheoke Creek at Stockton
20	01465970	NB Rancocas Creek at Browns Mills
18	01467120	Cooper River at Lindenwold
18	01467140	Cooper River at Lawnside
14		Mullica River at Green Bank
17		Salem River at Courses Landing
20		SB Rancocas Creek at Hainesport

Table 3.1b-4: Fecal Coliform Stations Delisted From 1998 303(d) List

WMA	Station Number	Station Name
06	01380500	Rockaway River at Boonton
04	01388500	Pompton River at Pompton Plains (Packnack Lake)
09	01405302	Matchaponix Brook at Spotswood
14	01409387	Mullica River at Outlet of Atsion Lake at Atsion
14	01409500	Batsto River at Batsto
15	01410784	Great Egg Harbor River near Sicklerville
15	01411000	Great Egg Harbor River at Folsom
01	0144000	Flat Brook at Flatbrookville
20	01467000	NB Rancocas Creek at Pemberton

It is noteworthy to mention that New Jersey proactively adopted EPA's guidance as the basis for New Jersey's SWQS criteria. Adoption of this guidance into state's SWQS was encouraged but not mandated. Some states may report comparatively higher attainment of recreational designated uses than New Jersey, however, this may be a function of less stringent SWQS criteria in that state. EPA is moving toward requiring states to adopt EPA criteria for e.coli and/ or enterococcus by 2003.

As mentioned in the 2000 305(b) Report, trends between 1986 and 1995 were assessed by USGS (USGS, 1999). Statistically significant trends were identified at 12 of 75 New Jersey stations. Of these, 5 locations had trends of environmental importance (i.e., change in concentration greater than 100 FC/100 ml per year). These trends are summarized on Table 3.1b-5 below.

Table 3.1b-5: Stations with Significant Trends in Fecal Coliform (1986-95)

Station #	Station Name	FC Geomean (MPN/100 ml) [1]	FC % >400 MPN/ 100 ml [1]	Trend (FC/ 100 ml per year) [2]
01393450	Elizabeth River at Ursino Lake	2508.8	85.7%	- 4700
01464000	Assunpink at Trenton	2002.4	88.9%	+ 870
01467069	NB Pennsauken Creek at Cherry Hill	2261.7	85.7%	- 400
01464515	Doctors Creek at Allentown	341.2	35.7%	- 260
01398620	NB Raritan River near Chester	106.9	14.3%	- 210

Notes:
1. 1996-2000 data
2. 1986-95 trends from USGS, 1999 (-) indicates declining concentrations and improving water quality; (+) indicates increasing concentrations and worsening water quality.

Recreational Designated Use Source and Cause Assessment

It is important to consider the source of fecal coliform pollution since specific sources of fecal coliform pollution have not yet been identified. With compliance of permit limits for fecal coliform at wastewater treatment plants high and incidence of treatment plant failures low, it is suspected that most fecal coliform pollution in freshwater rivers and streams is derived from animal wastes.

Fecal coliform pollution is suspected to occur primarily from domestic pets, livestock and wild animal wastes which are transported to rivers and streams by municipal and industrial stormwater, overland runoff, and by direct contact with water. Although Canada Geese population data are not readily available, significant populations of these birds occur in and around many New Jersey waterways. In developed areas, domestic pet and bird wastes (e.g., pigeons) contribute to fecal coliform in stormwater. In agricultural areas, animal manure piles and access of livestock to streams can contribute to fecal coliform pollution.

In localized instances, fecal coliform pollution may be attributed to human wastes from combined sewer overflows, failing sanitary sewer infrastructure, failing or inappropriately located septic systems, and occasionally from wastewater treatment plant failures. Compliance with permit limits for fecal coliform at New Jersey wastewater treatment plants is very high. (WCE, *Pers. Comm.*, 6/2000).

Combined sewer overflows (CSOs) are pipes that discharge combined sanitary and stormwater under wet weather conditions. In New Jersey, there are approximately 300 CSO discharge points located primarily in older cities in northeastern New Jersey and in Trenton and Camden. Most CSOs discharge to tidal waters, except those located in Patterson. As first shown in the 2000 305(b) Report, levels of fecal coliform are higher downstream of the Patterson CSOs (i.e., at the Passaic River at Elmwood Park - station # 01389880) than upstream (i.e., Passaic River at Little

Falls – station # 01389500). This assessment was conducted to support the CSO Program Memorandum of Agreement with EPA Region II.

Improving Stream Sanitary Quality

The following programs and activities are intended to improve the sanitary quality of New Jersey streams:

Evaluate Human Health Risk: Currently, most fecal coliform monitoring occurs at locations that are sampled as part of the ASMN. Based on conversations with field sampling personnel, these locations are not widely used for swimming or boating in rivers. Through the Watershed Management process, the Department plans to identify river locations used for swimming and boating and explore cooperative monitoring at these locations. Fecal coliform data collected at locations used for swimming and boating will provide more relevant information regarding potential exposure to pathogens. Since exposure to human waste poses a greater health risk than exposure to animal waste, it may also be important to conduct additional testing to evaluate human and animal sources of pathogens, for example using bacteriopahge assays.

TMDL Development: Areas that exhibit contravention of SWQS, with respect to fecal coliform, will be evaluated as TMDLs are planned and developed. The factors that contribute to these contraventions will be identified and managed according to the schedule developed in the TMDL Memorandum of Agreement (see 2 year TMDL Schedule and Priority Listing in Appendix 1C and 1B).

Source Identification: As TMDLs are developed, sources of fecal pollution will be identified. Sanitary surveys will be conducted to identify failing or inappropriately placed septic systems, cross-connections and interconnections between sanitary and storm sewer infrastructure, livestock waste, pets and wildlife, etc. Sanitary surveys were successfully used in the Whippany River watershed to identify an area affected by failing septic systems. Sanitary surveys have been a significant component of source identification in New Jersey's coastal waters to protect shellfish beds and bathing beaches.

Source Management: As Municipal Stormwater Planning and Permitting programs are implemented, connections between sanitary and storm sewers will be corrected. NJDEP is working with the New Jersey Department of Agriculture to identify and map confined animal feeding operations to ensure proper management of these facilities. Through Watershed Management and TMDL development, geese management strategies, pet waste ordinances, and storm sewer maintenance, septic system maintenance, siting and as appropriate, removal will be explored and implemented on a watershed specific basis. The Environmental Infrastructure Trust's State Revolving Fund and Nonpoint Source Grants can provide low interest loans and grants to address sanitary water quality problems.

FIGURE 3.1b-1. **Recreational Designated Use Assessment Status of Stations.** Includes delisted sites and sites carried over from the 1998 303(d) List.

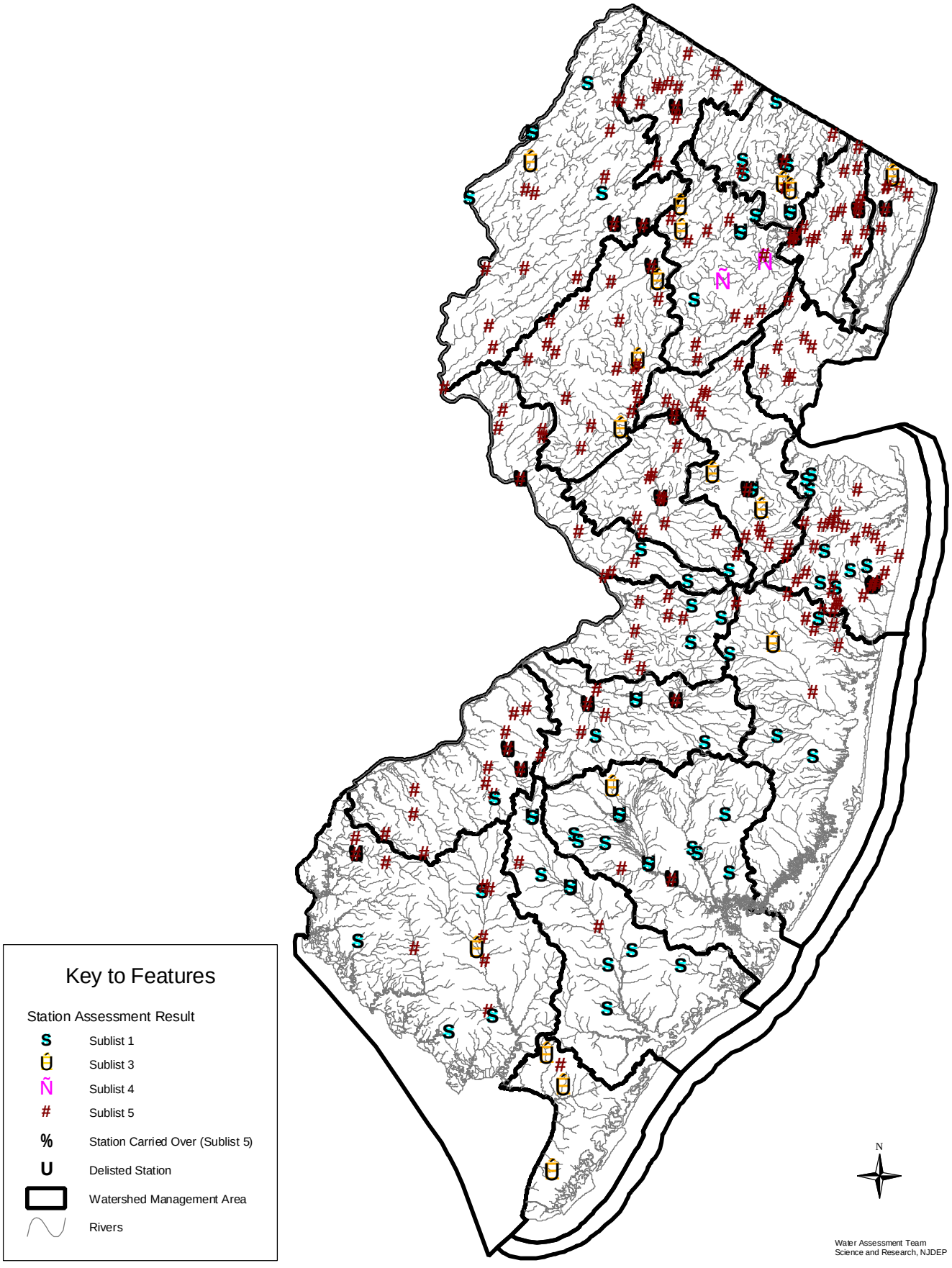
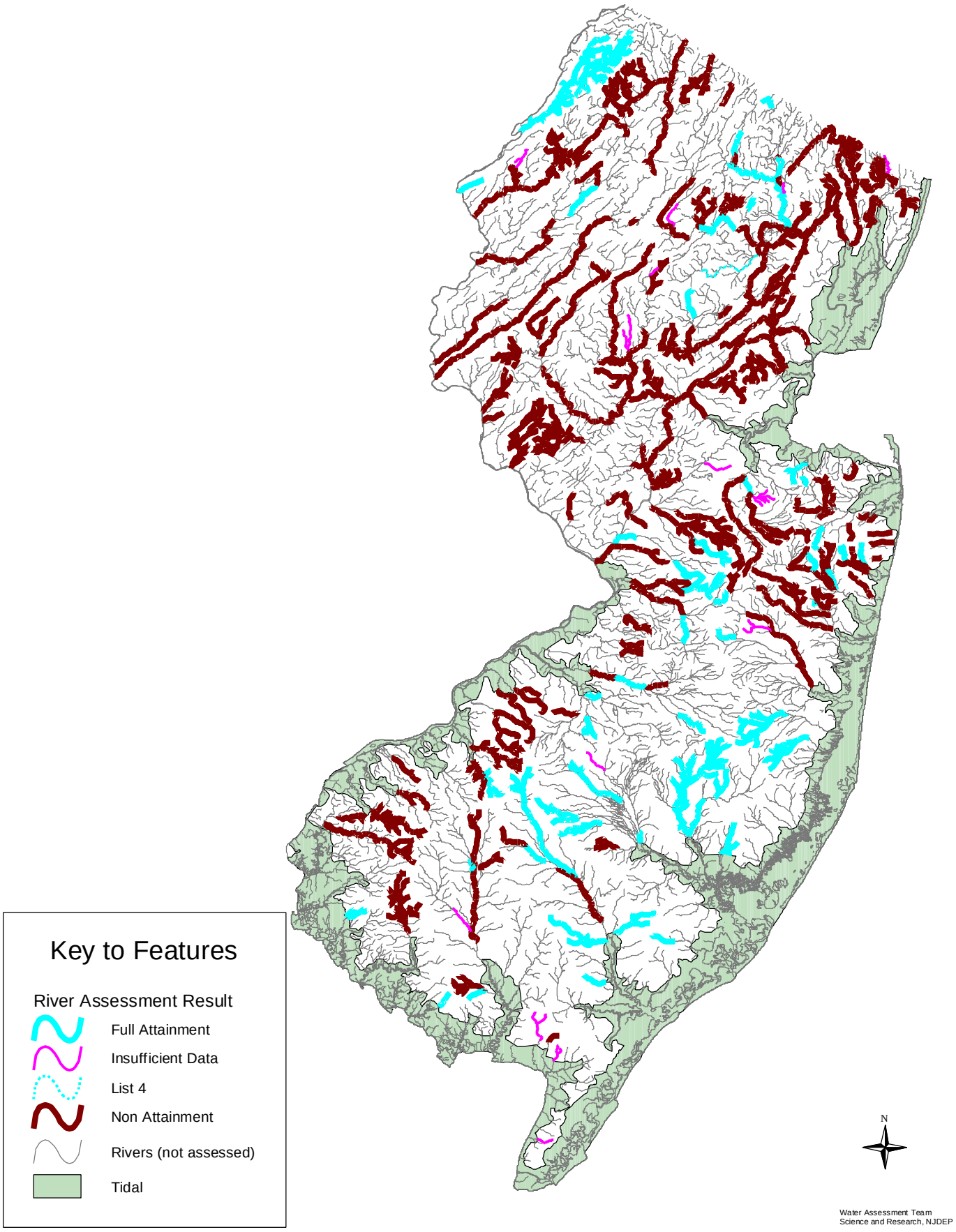


FIGURE 3.1b-2. Recreational Designated Use Assessment Status of River Segments. Includes monitored and estimated rivers.



Section 3.1c Rivers and Streams Drinking Water Designated Use Assessment

All surface waters in NJ are designated as drinking water supplies under the NJ Surface Water Quality Standards (SWQS). Currently, there are 54 potable surface water supply intakes in the state, mostly clustered in northern NJ with many of them located on reservoirs. (See Figure 3.4-1). These waters presently being used for public drinking water supplies are only a small portion of the total surface water in the state, however, all waters are evaluated for their potential to be drinking water supplies. This assessment provides an overview of finished drinking water quality, water quality in current source waters, and water quality in surface waters that are designated as potable supplies but are not currently used for that purpose.

Source Water Assessment Program (SWAP) Under SWAP, New Jersey will delineate areas which have the potential to influence waters (surface and ground) serving as public drinking water sources (NJDEP, 1998). Within these areas, the state will identify the origins of a wide range of contaminants and identify the vulnerability of the water systems to these contaminants. The SWAP will delineate waters requiring only conventional treatment (coagulation, sedimentation and filtration,) and those requiring additional treatment methods. The program will also delineate sources at risk in the future.

Rivers and Streams Drinking Water Designated Use Assessment Results

Drinking Water Quality:

Drinking water quality provided by water purveyors provides excellent information regarding the quality of finished drinking waters, which are regulated for many constituents under Federal and State Safe Drinking Water Acts. In addition, New Jersey's Safe Drinking Water Act provides additional protection through the regulation of 28 constituents that are either not regulated under the Federal Safe Drinking Water Act or are regulated at lower concentrations in New Jersey.

Finished water from community water systems in this state is of high quality. Environmental indicators developed and reported as part of NEPPS have shown that since 1995, the number of community water systems in New Jersey that have met all safety standards has remained consistently high - between 97% and 99% for microbiological standards and between 87% and 93% for chemical standards. (NJDEP, in press)

Between 1993 and 1995, less than 1% of 625 community water systems reported samples with nitrate concentrations above 10 ppm. However, 10-12% of all public water systems reported nitrate concentrations equal to or above 5 ppm indicating vulnerability to nitrate contamination. (NJDEP, 1998). Note that these results are for both surface and ground water sources.

Water Quality in Current Source Waters

Nitrate was chosen as an indicator of Drinking Water Designated Use Attainment because it is difficult and expensive to remove from potable supplies. To protect against adverse health effects, nitrate is regulated at 10 ppm in the Federal and State Safe Drinking Water Act regulations and New Jersey Surface Water Quality Standards (SWQS). The SWQS in the Pinelands was set at 2 ppm to protect the unique ecology of this area. In addition, information regarding additional treatment to remove chemicals in surface water supplies will be used.

Of the 54 surface water potable intakes in the state, only 13 had monitoring stations located nearby (see Figure 3.1c-3). Average concentrations were significantly below the SWQS and drinking water MCL for nitrate. None of the stations had any exceedances of the criteria, and only one station, Passaic River at Little Falls, had any nitrate concentration even close to the criteria. It seems the only significant concern is the increasing trend for nitrate at several sites that may become an issue to the purveyors in the future. Results are summarized for the 14 monitoring stations located near potable supplies in Table 3.1c-1 below.

Table 3.1c-1: Nitrate Status and Trends in Rivers Near 13 Public Surface Water Intakes

Public SW Intake	Site Number	Site Name	Average NO_3	Maximum NO_3	NO_3 Trends
Franklin PWW	01367715	Wallkill River at Scott Rd. at Franklin	0.35	0.54	NSIG
NJ American Water Co. (WC)	01379530	Canoe Brook near Summit	0.34	0.55	
Passaic Valley WC	01388500	Pompton River at Pompton Plains	0.71	1.50	NSIG
NJ American WC	01389500	Passaic River at Little Falls	2.20	7.90	0.27
United Water	01390500	Saddle River at Ridgewood	1.40	1.80	0.16
United Water (same site as above)	01390510	Saddle River at Ridgewood Ave. at Ridgewood	1.33	1.60	0.16
Orange WD	01393960	WB Rahway River at Northfield Ave. at West Orange	0.82	1.20	
Rahway WD	01395000	Rahway River at Rahway	1.02	2.10	NSIG
Elizabethtown WC	01400500	Raritan River at Manville	1.27	2.30	NSIG
Elizabethtown WC	01402540	Millstone River at Weston	NA	NA	
Elizabethtown WC	01403300	Raritan River at Queens Bridge	2.00	3.85	NSIG
United Water	01405195	Matchaponix Brook at Englishtown	0.75	0.99	NSIG
NJ American WC	01407750	Shark River near Neptune	NA	NA	
NJ American WC	01407760	Jumping Brook near Neptune	NA	NA	

Through the SWAP program, additional nitrate data collected by water purveyors is expected to become available. These data will be used to better characterize nitrate status and trends at intakes and in finished drinking water quality.

Water quality in surface waters that may be used as drinking water sources

Overall, nitrate levels throughout the state are well below the criteria for drinking water designated uses. The average concentrations of sites sampled for nitrate throughout the state is 1.02 mg/l. Several sites that fully attained standards did have elevated nitrate concentrations as seen in Table 3.1c-4. Only 2 sites exceeded the standards for drinking water designated use, Dead River near Millington and Great Swamp Branch below Rt. 206 near Hammonton (see Table 3.1c-3). While Dead River has several dischargers located along its banks including a wastewater treatment plant, Great Swamp Branch has no permitted dischargers and may be heavily impacted by nonpoint sources.

All 4 of the sites listed on the 1998 303(d) List were de-listed (see Table 3.1c-5). More recent data show that conditions have improved along the Great Egg Harbor River and Hammonton Creek. Likely explanations are the removal of a wastewater treatment plant on the Great Egg Harbor River when sewer systems were regionalized, and upgrades to the wastewater treatment plant on Hammonton Creek.

Results of the nitrate assessment are summarized below in Table 3,1c-2. Results for individual stations are depicted in Figure 3.1c-1 and in Table II-7 and Table II-13 in the Appendix

Table 3.1c-2: Nitrate Status

Nitrate Status	Number of Stations	Percent of Stations	Number of Assessed River Miles		Percent of Assessed River Miles	
			Monitor	Estimate	Monitor	Estimate
Sub-List 1	256	94%	1555	453	95%	97%
Sub-List 3	15	5%	71	0	4%	0%
Sub-List 4	0	0%	0	0	0	0%
Sub-List 5	2	1%	17	13	1%	3%
Totals	273	100%	1643	466	100%	100%

Table 3.1c-3: Nitrate Sites Exceeding SWQS

WMA	Station Number	Station Name	Number of Samples	Percent Exceed	Median Nitrate
06	01379200	Dead River near Millington	16	12.5%	4.94
14	0140941070	Great Swamp Branch below Rt. 206 near Hammonton	23	56.5%	2.15

Table 3.1c-4: Nitrate Sites With Elevated Samples or Median Concentrations

WMA	Station Number	Station Name	Number of Samples	Maximum Nitrate	Median Nitrate
02	01367770	Wallkill River near Sussex	23	9.00	1.44
05	01377499	Musquapsink Brook at River Vale	8	7.60	2.15
04	01382000	Passaic River at Two Bridges	58	6.60	2.10
04	01389500	Passaic River at Little Falls	26	7.90	2.20
04	01391490	Saddle River at Rochelle Park	4	5.30	4.25
04	01391500	Saddle River at Lodi	23	9.10	4.62
10	01400640	Millstone River near Grovers Mills	8	6.00	4.45
09	01405302	Matchaponix Brook at Spotswood	15	9.76	4.49
14	01409402	Hays Mill Creek near Chesilhurst (Pinelands)	21	1.60	1.07
14	01409416	Hammonton Creek at Westcoatville (Pinelands)	22	2.20	1.18
15	01411035	Hospitality Branch at Blue Bell Road near Cecil (Pinelands)	12	1.80	1.21
16	01411441	Savages Run in Belleplain State Forest (Pinelands)	4	1.60	1.40
17	01412800	Cohansey River at Seeley	23	5.96	4.65
20	01464000	Assunpink Creek at Trenton	10	5.70	2.90
20	01464020	Assunpink Creek at Peace Street at Trenton	12	8.40	4.29
18	01467081	SB Pennsauken Creek at Cherry Hill	15	13.02	2.59

18	01477440	Oldmans Creek at Jessups Mill	4	5.25	4.45

Table 3.1c-5: Nitrate Sites Delisted From 1998 303(d) List

WMA	Station Number	Station Name
14	01409416	Hammonton Creek at Westcoatville
15	01410784	Great Egg Harbor River near Sicklerville
15	01411000	Great Egg Harbor River at Folsom
15	01411110	Great Egg Harbor River at Weymouth

In a USGS trend study of nitrated concentrations between 1986 and 1995 statistically significant declining trends in nitrate concentration were found at 11 stations indicating improving water quality at these locations. No statistically significant trends were found at 44 locations, indicating stable water quality, and statistically significant increasing trends in nitrate concentration were found at 24 stations indicating worsening water quality at these locations. However, the rate of change in nitrate concentrations was small, ranging from 0.01 ppm NO_3 per year to 0.35 ppm NO_3 per year. The trends assessment conducted by USGS indicates that drinking water designated uses, as indicated by nitrate in streams, will continue to be met through 2004.

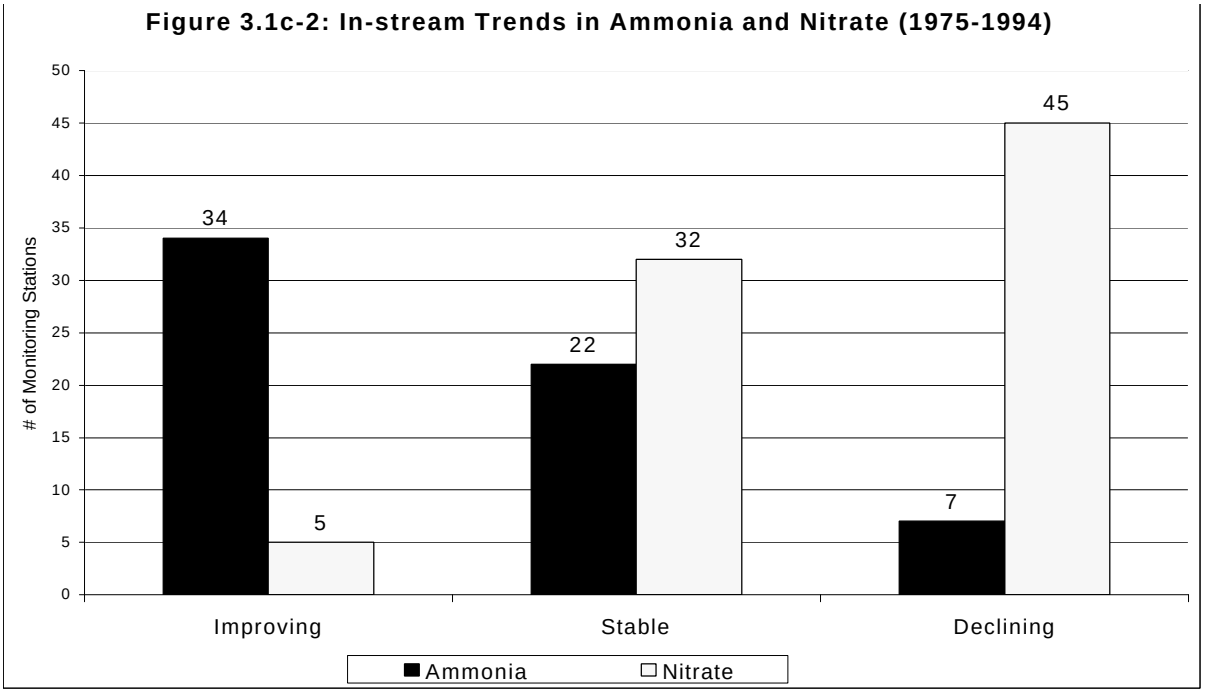
Drinking Water Designated Use Source and Cause Assessment

A qualitative assessment of nitrate sources is provided below. Both point and nonpoint sources contribute to rising levels of nitrate. Point sources contribute nitrate through secondary treated effluent while nonpoint sources primarily contribute through the application of fertilizers to lawns and farms, through animal waste, and atmospheric deposition.

Point Source Assessment: Upgrades of wastewater treatment plants to secondary treatment resulted in statewide compliance with unionized ammonia, which is toxic to aquatic life and elevated in primary treated sewage. However, secondary treated sewage contains elevated nitrate, as a result of converting the toxic unionized ammonia to nitrate. A comparison of trends in total ammonia and nitrate between 1975 and 1994 using data from the Department's ambient monitoring network illustrates the transition to secondary treatment.

During this time period, concentrations of unionized ammonia decreased at 37 stations (54%), while concentrations of nitrate increased at 46 stations (55%). See Figure 3.1c-2.

Figure 3.1c-2: In-stream Trends in Ammonia and Nitrate (1975-1994)



Nonpoint Source Assessment: Nitrates have been applied to land surfaces as fertilizers for agricultural purposes and lawns. Low concentrations of nitrate also arise from forests. Nitrates that are not used by plants (crops or lawns) travel through the soil to surficial aquifers, deeper ground water and streams. In the sandy NJ coastal plain, these fate and transport processes are well understood and can be modeled. Predictive modeling provides a useful tool to estimating future surface and ground water quality under various management scenarios.

Strategies to Protect Potable Supplies: **Nitrate**

Nitrate concentrations are of particular concern in the Passaic River Basin due to intensive water uses, particularly under record low stream flow stream conditions that were experienced in recent years. In October 1999 the NJDEP's Division of Water Quality and Water Supply Administration retained a consultant to initiate a demonstration project concerning the potential to reduce the amount of nitrates discharged from wastewater treatment plants into the Passaic River. The project evaluated a technique know as On-Off Aeration. By periodically turning their aeration systems on and off the facilities were able to show significant reductions in the amount of nitrates discharged as well as reductions in energy usage.

The status and trends in nitrate concentrations will continue to be examined in detail in the Safe Drinking Water Program. In addition, sources of nitrate that may affect potable supplies will be identified and targeted for management in the Source Water Assessment Program.

FIGURE 3.1c-1. Drinking Water Assessment Status by Stations. Includes sites delisted and carried over from the 1998 303(d) List.

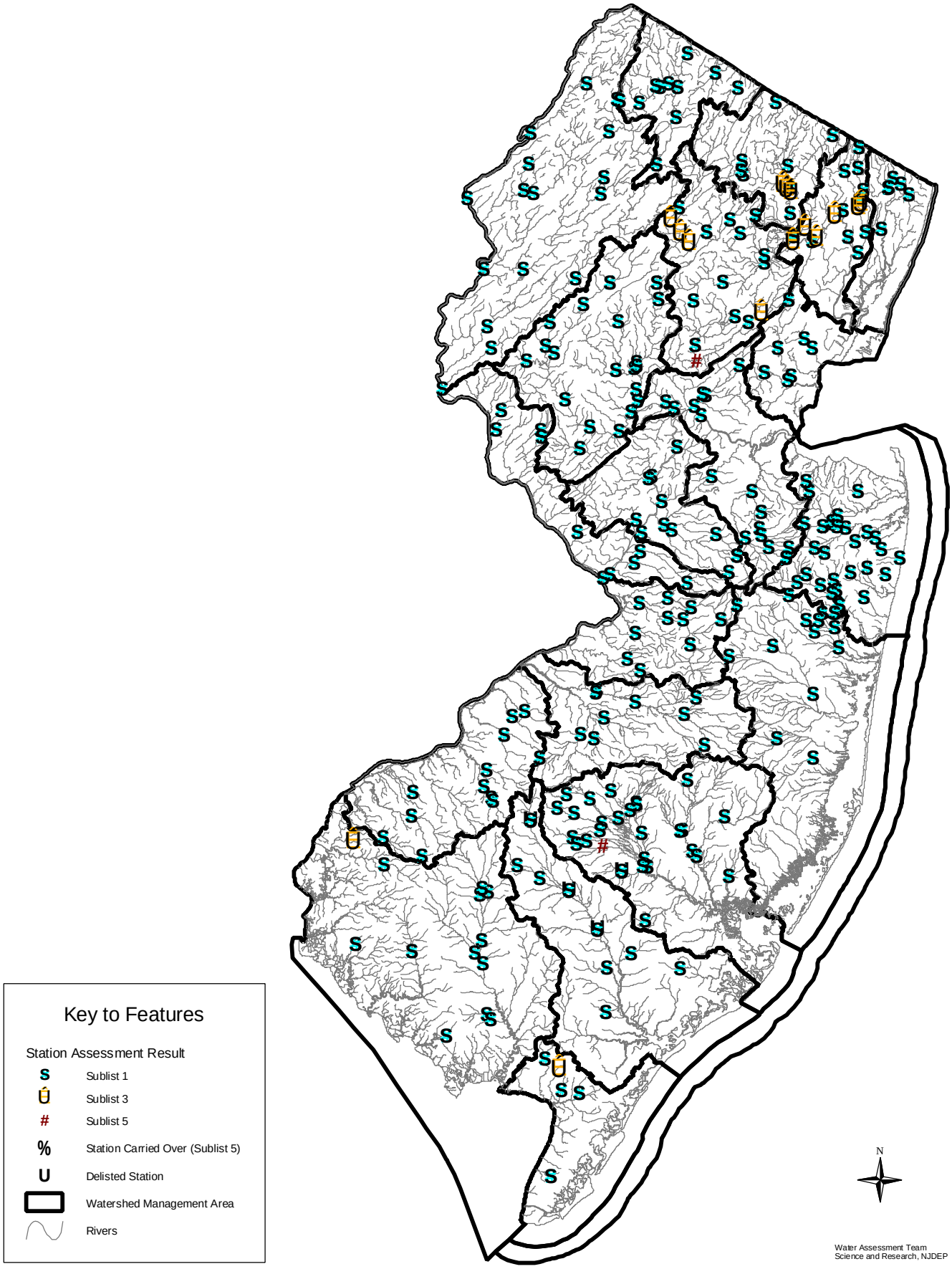


FIGURE 3.1c-2. Drinking Water Assessment Status for River Segments. Includes monitored and estimated rivers.

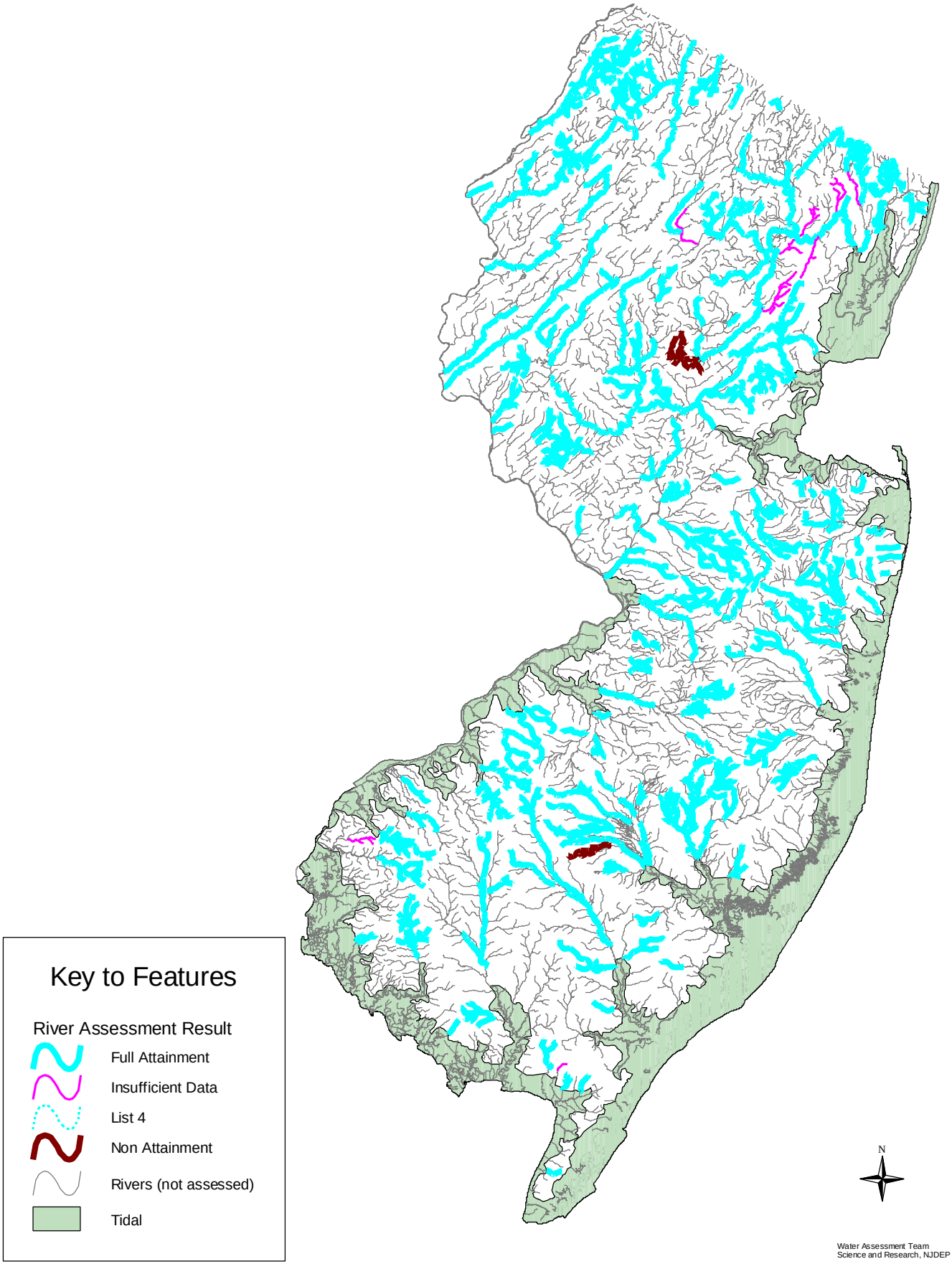
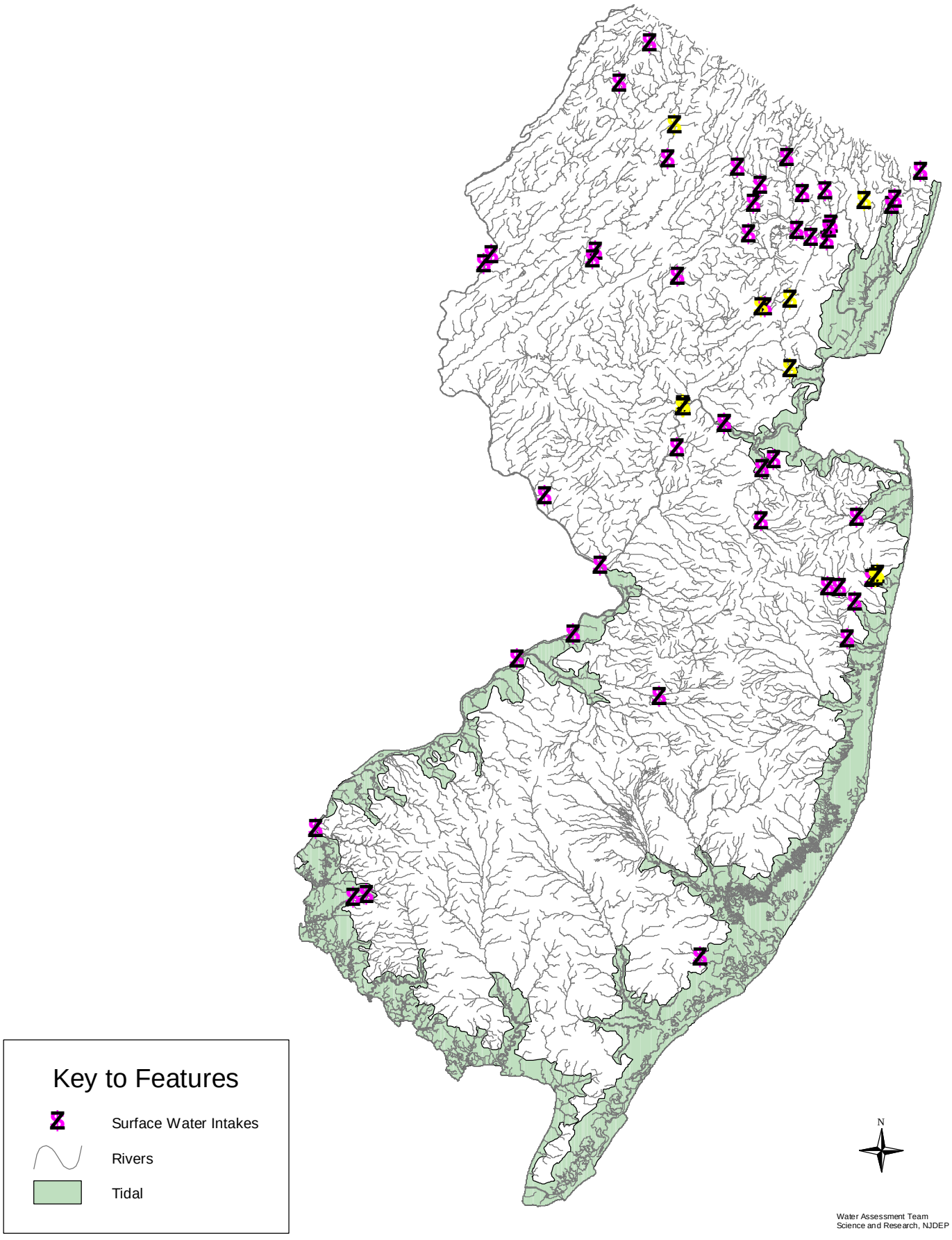


FIGURE 3.1c-3. Potable Surface Water Supply Intakes. Light shaded symbols represent sites with sampling sites nearby and are described in Table 3.1c1.



Section 3.1d Rivers and Streams Agricultural Designated Use Assessment

Rivers and Streams Agricultural Designated Use Assessment Results

At the present time, New Jersey's SWQS have not been established specifically for agricultural designated use. Although designated uses such as human health, ecosystem protection, drinking water supply, and fishing have standards established that are applicable to agriculture, the water-quality standards suitable for agriculture are normally higher, precluding the need for criteria specific to agricultural uses. To evaluate water supplies that support agriculture in New Jersey, total dissolved solids (TDS) and salinity were selected as the determining parameters. For this report, only TDS was used as the standard since salinity data was not available for the waterways in this assessment. Currently, the SWQS for total dissolved solids is 500mg/l, however, criteria for TDS applied to agricultural use is 2,000 mg/l. The criteria of 500 mg/l was established for aquatic life protection and secondary drinking water standards.

Assessment results for TDS indicate three sites exceeding the criteria, however, none of these sites had maximum values exceeding the criteria applicable to agricultural designated use. There are no confirmed waterways that do not support agricultural designated uses. A summary of agricultural designated use assessment results are summarized in Table 3.1d-1 below.

Table 3.1d-1. Agricultural Designated Use Status

TDS Status for Agricultural Use	Number of Stations	Percent of Stations	Number of Assessed River Miles		Percent of Assessed River Miles	
			Monitor	Estimate	Monitor	Estimate
Sub-List 1	200	84%	1275	374	87%	83%
Sub-List 3	37	16%	196	75	13%	17%
Sub-List 4	0	0%	0	0	0%	0%
Sub-List 5	0	0%	0	0	0%	0%
Totals	237	100%	1471	449	100%	100%

Section 3.1e Rivers and Streams Industrial Designated Use Assessment

The industrial designated use assessment evaluates attainment of the Surface Water Quality Standards (SWQS) for the protection of waters used for processing or cooling. The methodology incorporates pH and total suspended solids (TSS) as the determining parameters if a waterbody is suitable for industrial use. Because these standards are protective of the most sensitive use, protecting aquatic life, the SWQS should ensure protection of the waterbody for industrial water supply. However, water quality needs of industry vary significantly and exceeding the standards may not necessarily indicate the source waters are unsuitable for the industries in that particular location.

Rivers and Streams Industrial Designated Use Assessment Results

A summary of pH and TSS assessments are shown in Tables 3.1e-1 and 3.1e-2 respectively. Of the impaired pH and TSS sites, only three sites did not meet the criteria for both parameters, Nechanic River at Reaville, Millstone River near Manalapan, and Stony Brook at Princeton. The results for these sites indicate these rivers are most susceptible to not meeting industrial designated uses since both parameters were exceeded. Although the assessment indicates 76 sites do not meet the criteria for pH or TSS, there are no areas in the state where a water supply is confirmed to be unsuitable for industrial use.

Table 3.1e-1. pH Status

pH Status	Number of Stations	Percent of Stations	Number of Assessed River Miles		Percent of Assessed River Miles	
			Monitor	Estimate	Monitor	Estimate
Sub-List 1	126	45%	897	367	76%	54%
Sub-List 3	89	31%	352	20	4%	32%
Sub-List 4	0	0%	0	0	0%	0%
Sub-List 5	69	24%	419	97	20%	14%
Totals	284	100%	1668	484	100%	100%

Table 3.1e-2. Total Suspended Solids Status

TSS Status	Number of Stations	Percent of Stations	Number of Assessed River Miles		Percent of Assessed River Miles	
			Monitor	Estimate	Monitor	Estimate
Sub-List 1	157	61%	1098	365	71%	79%
Sub-List 3	90	35%	364	52	23%	11%
Sub-List 4	0	0%	0	0	0%	0%
Sub-List 5	10	4%	95	48	6%	10%
Totals	257	100%	1557	465	100%	100%

Table 3.1e-2. Industrial Designated Use Status

	Number of Stations	Percent of Stations	Number of Assessed River Miles		Percent of Assessed River Miles	
			Monitor	Estimate	Monitor	Estimate
Sub-List 1	138	49%	909	366	55%	76%
Sub-List 3	70	24%	265	7	16%	1%
Sub-List 4	0	0%	0	0	0%	0%
Sub-List 5	76	27%	491	110	29%	23%
Totals	284	100%	1665	483	100%	100%

Maintaining and Improving Industrial Use Assessment

Clarify needed water quality: The use of pH and TSS assessments to determine the suitability of industrial source waters represents the Department's first attempt to assess industrial uses. As discussed previously, needs of industrial water users may vary significantly. In addition. ambient water monitoring networks are not designed to assess water quality at industrial intakes. Industrial users may have additional data regarding water quality and use attainment relevant to their intakes. Comments from industrial users are sought to improve this assessment.

FIGURE 3.1e-1. Industrial Designated Use Assessment Status of Stations. Assessment results based on pH and total suspended solids.

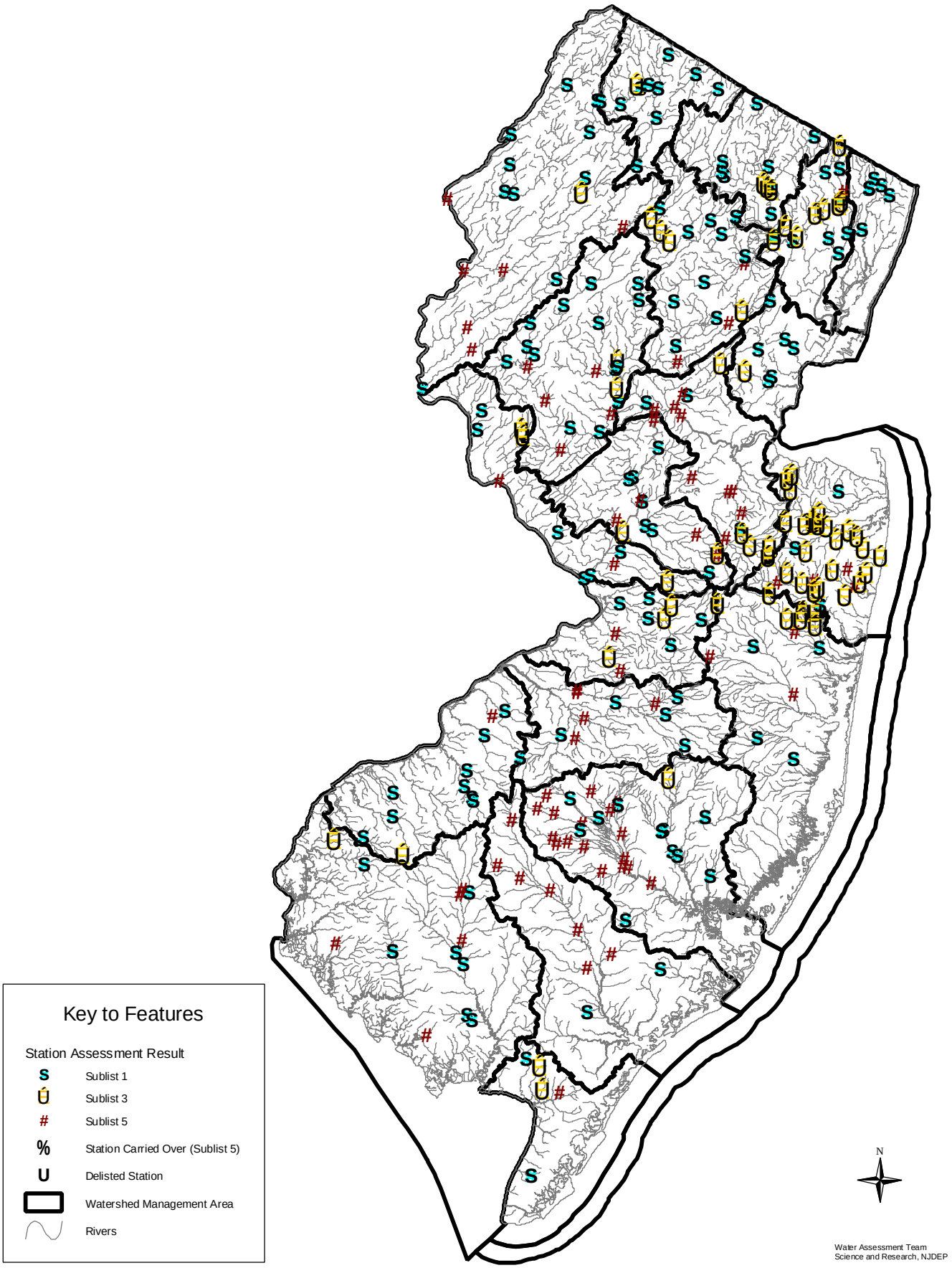
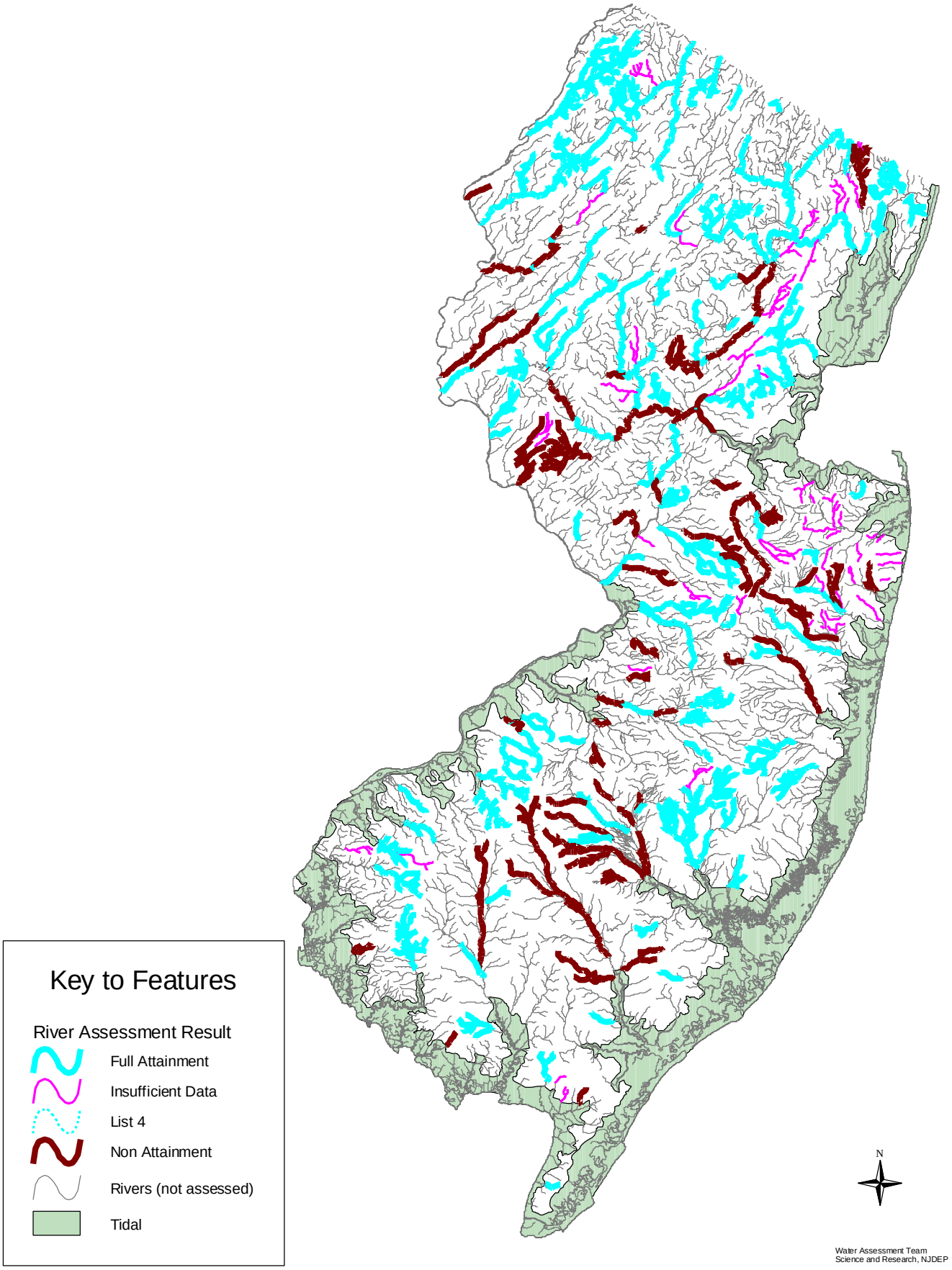


FIGURE 3.1e-2. Industrial Designated Use Assessment Status for River Segments. Includes monitored and estimated rivers.



Section 3.2 Lake Water Quality Assessment

Introduction

There are approximately 3,278 lakes, reservoirs and ponds over 2 acres size in New Jersey, but of these, only about 60 are natural. The remainder are constructed impoundments. There are 380 public lakes (24,000 acres) and 64 reservoirs. Thus far, 480 lake bathing beaches at 319 lakes have been identified; some lakes have multiple beaches. Uses of New Jersey's lakes, reservoirs and ponds vary and can include potable water supply, water storage, recreational boating, fishing and swimming. These waterbodies also provide habitat for a variety of aquatic life and wildlife.

This section focuses on aquatic life and recreational designated use attainments for lakes. This section also discuses eutrophication and its impact on the recreational quality of lakes. Fish consumption advisories for lakes are discussed in Chapter 4, section 4.1.

3.2a: Lakes Aquatic Life Designated Use Assessment

Method

The aquatic life use support assessment for lakes was based upon warm water fishery assessments supplied by the Department's Bureau of Freshwater Fisheries (BFF). Consistent with the previous Inventory Report, this assessment provides a direct indicator of aquatic life designated uses. Prior to the 2000 Inventory Report, aquatic life assessments for lakes were based on lake trophic status, an indirect indicator of aquatic life uses.

Prior to the 2000 Water Quality Inventory Report, eutrophic lakes were classified as "fully supporting aquatic life designated use, but threatened". However, aquatic plants, which grow in abundance in eutrophic lakes, provide food and habitat to the lake fish community. Many warm-water fish communities can thrive under moderate eutrophic conditions but may be impaired by severe eutrophication when dissolved oxygen levels are severely depressed and/or aquatic vegetation becomes excessively dense. Clean Lakes Program studies of trophic status identified recreational and aesthetic impairments, not impairments to fisheries. These trophic status assessments are included in Section 4.3c within this chapter.

Assessments of lake fisheries are performed based upon a priority list provided in the Division of Fish and Wildlife's Warmwater Fisheries Management Plan (NJDEP, 1998) which serves as the primary guidance for warmwater fisheries management for the Department. This 2002 New Jersey Water Quality Inventory Report, has expanded the use of these fishery assessments supplied by Bureau of Freshwater Fisheries. This report presents the assessment results of fish inventories of 40 lakes and reservoirs all of which possess public access for recreational fishing. These 40 waterbodies represent a total of 11,393 lake acres. With the exception of one lake, assessment dates range from 1992 to 2000. The one exception is New Market Lake in Middlesex County, a lake contaminated with PCB's from an upstream industrial source which has resulted in a total consumption advisory on the lake. Because of this and the poor quality of the lake fishery, the Division of Fish and Wildlife no longer manages the fishery and this precludes more up-to-date fish assessments.

Lakes Aquatic Life Designated Use Assessment: Results

Of the 40 lakes assessed by the Division of Fish and Wildlife totaling 11,861 acres, 34 lakes fully support the use, one lake is fully supporting but threatened, 4 lakes partially support the use, and one lake does not support the use. When categorized according to the Integrated List categories, the classifications are as displayed on Table 3.2a-1. The results of individual lake assessments are summarized below on Table 3.2a-2.

Table 3.2a-1: Lakes Aquatic Life Designated Use Assessment Summary (in acres)

Use Support Category	Number of Lakes	Acres	Integrated List
Full Attainment	34	7,916	**Sublist 1**
Non Attainment*	6	3,945	Sublist 5
Insufficient data	0	NA	Sublist 3
Total Acres Assessed	**40**	**11,861**	

*This category includes lakes assessed as threatened, partially supporting and not supporting the Aquatic Life Use.

Table 3.2a-2: Individual Lake and Reservoir Assessment Results Using Fisheries Data

Lake Name	Use Assessment	Latest Assessment Date	Reason for Less Than Full Support
Lake Aeroflex	Full Support	1995	
Brainerd	Full Support	1996	
Budd Lake	Full Support	1997	
Canistear Reservoir	Full Support	1993	
Clinton Reservoir	Full Support	1990	
Davidson's Mill	Partial Support	1997	Sedimentation/water quality
Davis Mill Pond	Full Support	2000	
Demott Pond	Full Support	1997	
Echo Lake Reservoir	Full Support	1991	
Elmer Lake	Full Support	1995	
Farrington	Full Support	1999	
Hopatcong	Threatened	1996	Accelerated eutrophication
Jefferson	Full Support	1997	
Lefferts	Partial Support	1998	pH
Manasquan Res.	Full Support	1996	
Maple Lake	Full Support	1996	
Maskells Millpond	Full Support	1997	
Menantico Pond	Full Support	1997	
Merrill Creek Res.	Full Support	2000	
Monksville Res.	Full Support	2000	
New Market	No Support*	1987	Fishery dominated by carp & goldfish.
North Community	Partial Support	1997	Sedimentation
Parvin	Full Support	1992	
Peddie	Full Support	1997	
Pemberton Lake	Full Support	1996	
Prospertown	Full Support	1997	
Ramapo Lake	Full Support	2000	
Round Valley Res.	Full Support	1996	
Ryker Lake	Full Support	1997	
Scarlet Oak Pond	Full Support	1994	
Shadow	Full Support	1994	

Table 3.2a-2: Individual Lake and Reservoir Assessment Results (cont.)

Lake Name	Use Assessment	Latest Assessment Date	Reason for Less Than Full Support
Shepherd	Full Support	1999	
Silver Lake	Full Support	1993	
Spruce Run Res.	Partial Support	1997	Frequent and significant water withdrawls
Sunset	Full Support	1998	
Union Lake	Full Support	1993	
Washington Valley Res.	Full Support	1997	
White Lake	Full Support	1998	
Wilson	Full Support	1993	
Wilson Park	Full Support	1997	

*PCB's in fish tissue resulting in Total Consumption Advisory. Lake is no longer managed by the Division of Fish and Wildlife.

Source and Cause Assessment

Spruce Run Reservoir in Hunterdon County was classified as partially supporting aquatic life designated uses. This impairment has been attributed to frequent and significant water withdrawals which cause significant oscillations in water levels. This has eliminated all vegetation within the reservoir, a critical component of fish cover. The lack of adequate cover within the reservoir has affected the recruitment of a number of game species. "Recruitment" here refers to the number of young fish which survive to ultimately become large enough to reproduce and/or become harvestable. In addition the reservoir receives nutrient laden runoff during storm events from the upstream watershed and exhibits dense algal blooms during the summer months. The Bureau of Freshwater Fisheries has found dissolved oxygen levels from approximately 12 feet down to the lake bottom (70 ft.) that are routinely reduced to 0 mg/l DO during the summer months. Spruce Run Reservoir was not studied by the Clean Lakes Program.

Lake Hopatcong was classified as fully supporting aquatic life uses but threatened due to accelerated eutrophication brought about by nonpoint source pollution from the communities immediately surrounding the lake, especially from septic systems. Lake Hopatcong was also classified as eutrophic by the Clean Lakes Program.

Strategies to Protect and Enhance Aquatic Life Uses in Lakes

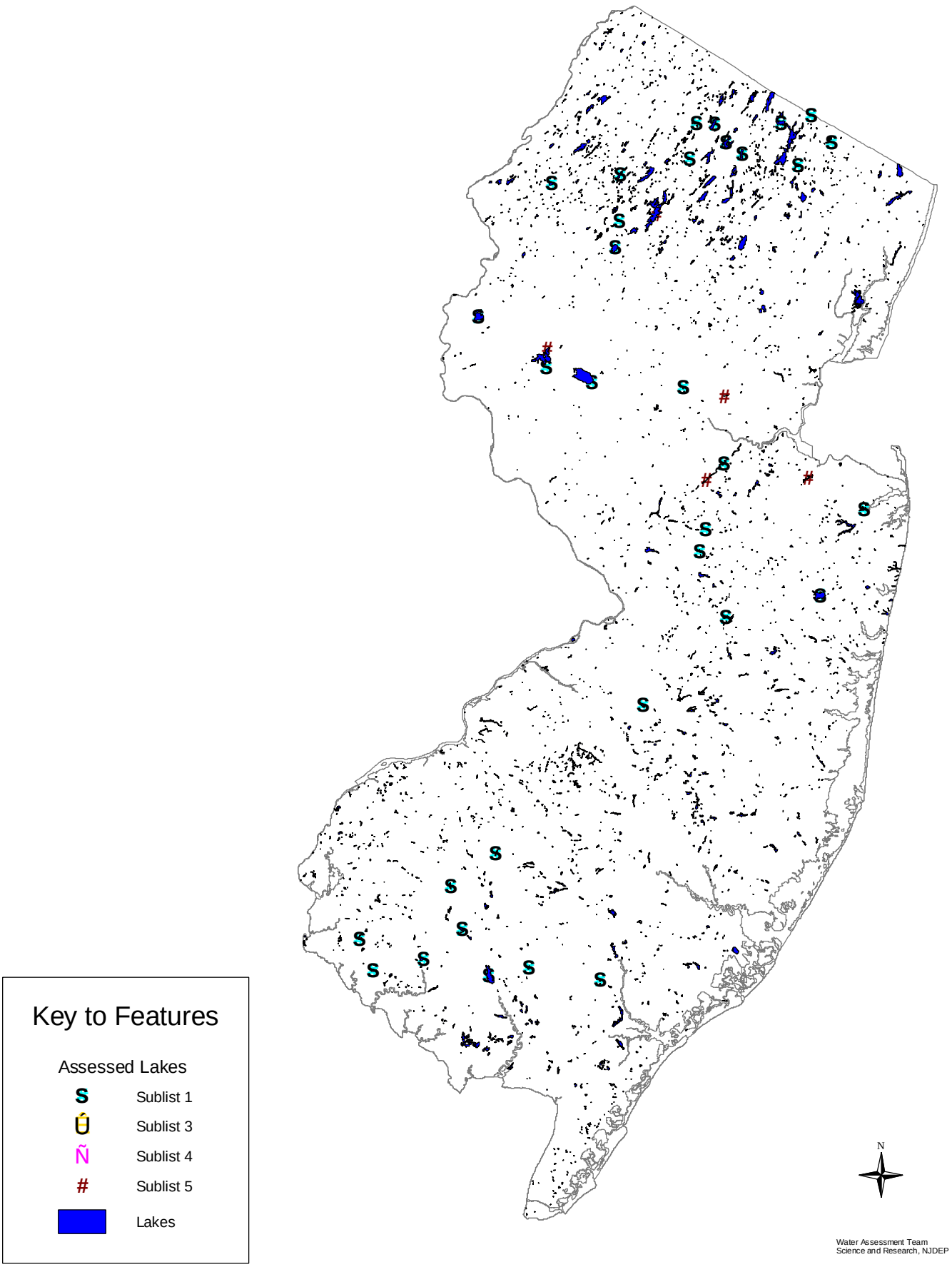
Implement management measures for fisheries: Numerous management measures are identified in the Warmwater Fisheries Management Plan such as lake dredging when needed, aquatic vegetation control and angler education.

Expand the use of direct measures of aquatic life designated use status: NJDEP plans to make wider use of fishery inventories provided by the Department's Bureau of Freshwater Fisheries. In addition, NJDEP and USEPA Region II have developed draft rapid bioassessment protocols for lakes. The Department is currently evaluating whether these protocols need additional verification and how best to integrate these assessments with the existing fin-fish assessments.

Once these efforts are completed and sufficient data are available, these new data will be integrated into the Aquatic Life Use support status of public lakes for future Water Quality Inventory Reports.

Additional lake management strategies to control eutrophication are discussed under Section 3.2c, Lake Recreational Designated Use: Aesthetics.

FIGURE 3.2a-1. Aquatic Life Designated Use Status for Lakes.



Section 3.2b: Lakes Recreational Designated Use Assessment: Sanitary Quality

Lake bathing beaches are monitored for sanitary quality by county and local health departments with oversight and program coordination from New Jersey Department of Health and Senior Services (NJDHSS). NJDEP's Cooperative Coastal Monitoring Program compiles NJDHSS data so that a more comprehensive picture of the quality of all NJ bathing beaches can be provided. In addition, many of the environmental programs available to maintain and improve lake water quality are operated through NJDEP. The Division of Watershed Management cooperatively prioritizes and implements projects needed to protect and improve lake bathing beaches.

Lake Recreational Designated Use Assessment Method

The assessment methods for Recreational Designated Use Assessment are delineated in Section 5.2 of the Methods Manual. The sanitary quality of water at the bathing beach is monitored by county and local health agencies. Some lakes included in this assessment are privately owned and operated, including camps, private schools, or lake associations. NJDHSS regulations govern the collection of these data and beach closures based on elevated levels of fecal coliform (FC).

Levels of fecal coliform bacteria are used to indicate the presence of fecal pollution which may be harmful to human health. Sanitary surveys are performed to identify and address bacterial pollution sources. Data for this assessment were provided by the NJDHSS and subsequently compiled by NJDEP's Cooperative Coastal Monitoring Program.

To date, 480 lake bathing beaches located on 318 lakes have been identified; some lakes have more than one beach. Recreational designated use attainment was assessed separately at each beach. Of the total of 318 lakes, 271 are recorded within the Department's Geographical Informational System (GIS), and 47 are not yet located within the system. The following summaries are based only on lakes in the GIS system as use attainment results must be reported to USEPA as lake acres. Lake acreages are not readily available for many of these small lakes not recorded in the GIS system. The Department is working to correct this deficiency and it is hoped to have all recreational lakes contained within the system in the near future.

Lakes Recreational Designated Use Assessment Results

Results are summarized on Table 3.2b-1 below. As shown on Table 3.2b-1, 197 (73%) lakes provided bathing beaches of excellent recreational swimming quality (full attainment of the use). Seventy-two lakes (26%) showed non attainment of the primary contact use based upon the sanitary quality of their bathing beaches. Two lakes (1%) were listed on Sublist 3 due to insufficient data needed to make an assessment (beach was either closed or data were not provided). This represented Wood Lake in Medford Township. and Sachaawea Camp on Gorden Lake in West Millford Township. Results for individual lakes are provided in Integrated List Tables.

Expressed as lake acres, the information above for the 271 lakes located on GIS is as follows: 15,147 acres (81%) fully support recreational uses and are listed on Sublist 1; 3,473 acres (19%) do not support recreational uses and are placed on Sublist 5; and seventeen acres (0.1%) were assessed as not possessing sufficient data to make an assessment and are listed on Sublist

3. As discussed above, efforts are underway to locate the remaining lakes on GIS, facilitating a comprehensive spatial assessment of lake bathing beaches.

Table 3.2b-1: Lake Beach Recreational Designated Use Support and Corresponding Integrated List Status

Use Support Category	Number of Lakes in Each Category*	Acres	Integrated List
Full Support	197	15,148	Sublist 1
Insufficient Data	2	17	Sublist 3
Non Support	72	3,473	Sublist 5
Total Assessed	**271**	**18,638**	

***Lake acres are based upon lakes indexed within the Department's Geographic Information System (GIS) only. An additional 47 lakes were reported to the Department; however, because they are not indexed within the GIS system, their acreage are currently unknown and they are not included in the calculations of acres within each of the use support categories. A list of the lake names of 47 lakes of this subset is contained in Table 3.2b-2 below.

Table 3.2b-2. 47 lakes reported to the Department and not indexed within the GIS system. Their acreages are currently unknown and are not included in the calculations of acres within each of the use support categories displayed on Table 3.2b-1 above.

WMA	Beach Name	Status on Integrated List	WMA	Beach Name	Status on Integrated List
03	Awosting Association	1	01	Garden State Academy Pond	1
08	Baptist Camp and Conf. Ctr.	1	02	Glen Harbor HOA	1
01	Bell Lake	1	02	Harmony Ridge Beach at Small Lake	1
06	Belmont Left and Right	1	09	Hercules Pond	1
17	Camp Grice	1	03	Highlands/Weis	1
01	Camp Lou Henry Hoover	1	06	Hilltop Left and Right	1
01	Camp Taylor Lake-01	1	18	Hurff Lake	1
08	Cross Roads Outdoor Ministries (Camp Beisler)	1	14	Indian Lake-14	1
01	Crystal Springs: The Quarry	1	06	Inlet Left and Right	1
17	Double A Marina	1	06	Lafayette Municipal Beach	1
03	Lake Edenwold-03	1	08	Camp Bernie	5
19	Lion Tamers Club	1	19	Camp Darkwaters	5
08	Manor House Outlet	1	09	Carroll's Garden Lake	5
03	Middle Lake Village	1	06	Community Assoc. of Prospect Point	5
08	Pax Amicus Beach	1	06	Conference Center Left and Right	5

Table 3.2b-2 continued

WMA	Beach Name	Status on Integrated List	WMA	Beach Name	Status on Integrated List
17	Pickle Factory Dock	1	17	Gandy's Beach	5
17	Rabins Beach	1	02	Glen Lake	5
17	Southern NJ Council	1	01	Green Valley Beach Campground	5
10	Sturbridge Lake-10	1	18	Lake Silvestro	5
02	Toyes Recreation	1	19	Lakeside	5
06	Village Left and Right	1	03	Montclair YMCA Near Beach and Far Beach	5
17	Vineland YMCA	1	06	Morris County Park Lake, Beach, Inlet, Outlet,	5
08	Pavillion Beach	3	02	Tall Timbers POA	5
18	Sacajawea Camp	3			

Lake Recreational Designated Use Source and Cause Assessment

In general, the sources and causes of fecal contamination that bring about lake bathing beach closures are very similar to those affecting rivers and streams. Additional site specific information regarding sources of fecal coliform pollution at lake bathing beaches is expected to become available through the Watershed Management Program.

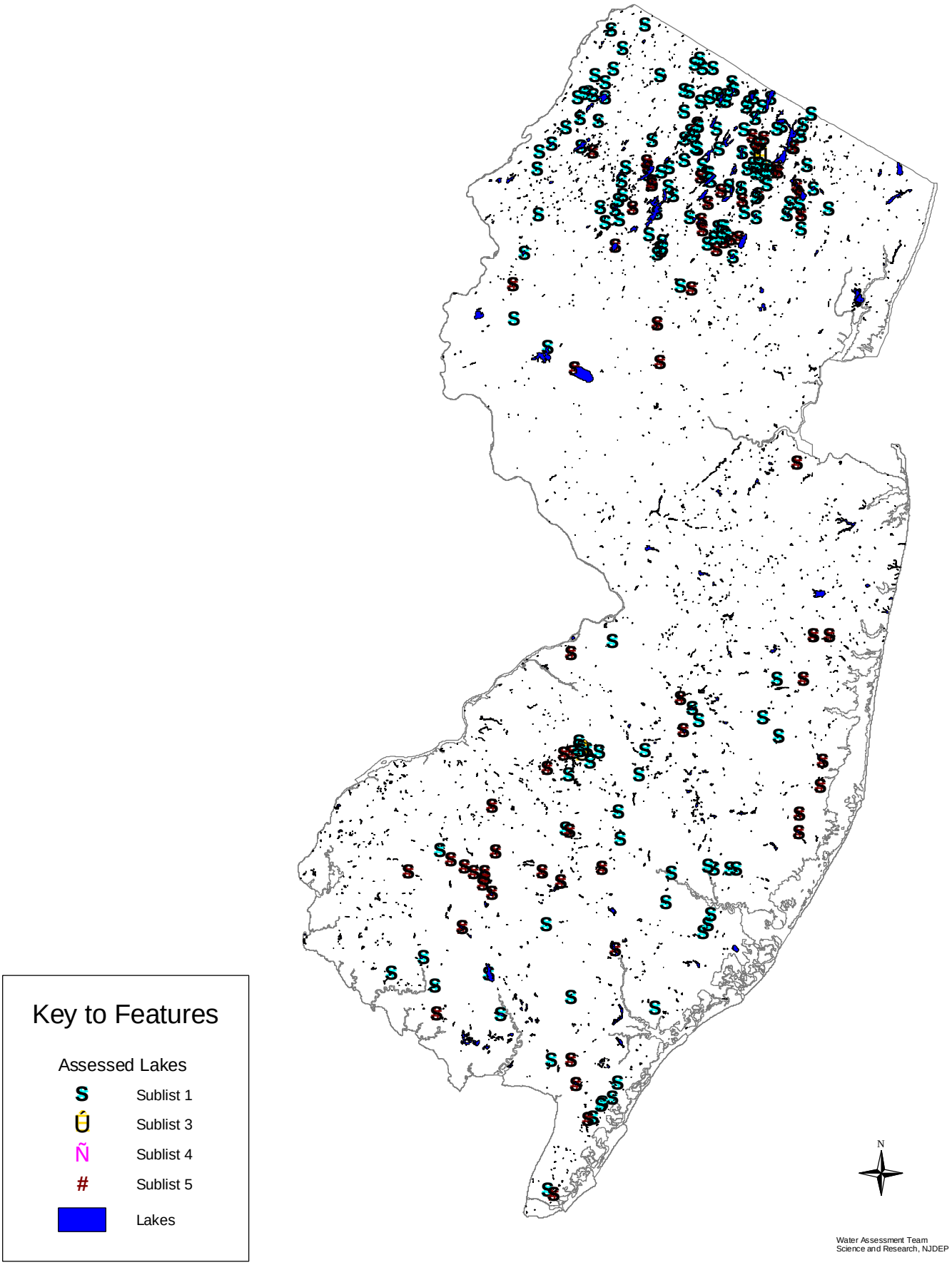
Maintaining and Improving Lake Recreational Designated Uses

Continue remediation efforts for eutrophic conditions at lakes with beaches: Through the Clean Lakes Program, remediation efforts for eutrophic conditions are ongoing or have been completed at several lakes with one or more bathing beaches, including Cranberry, Greenwood, Hammonton, Hopatcong, Manahawkin, and Swartswood Lakes. Additional information is provided in the 2000 305(b) Report, in the Appendix on Table A4.3.3-1 of "Lake Remediation under the Clean Lakes Program". Through the New Jersey Lakes Bond Act, remediation efforts are ongoing at several lakes with one or more bathing beaches, including Cranberry, Greenwood, Hammonton, Hopatcong, Mohawk, Pine, Round Valley, Swannanoa, Swartswood, and Sylvan Lakes. Additional information again is provided in the 2000 305(b) Report in Appendix A4.3.3-2: FY96 Lakes Bond Act Projects.

Continue and expand cooperative assessments with NJDHSS: The lake bathing beach data for this assessment were provided through the cooperative efforts of the Cooperative Coastal Monitoring Program and the NJDHSS. This initial effort made the lake bathing beach assessment possible. Future cooperative efforts should explore the exchange of lake beach closure data with NJDEP.

Improve spatial assessment: NJDEP and NJDHSS are working cooperatively to locate the remaining 66 lakes on GIS. The results will be used to complete the comprehensive assessment of lake bathing beaches for the next Water Quality Inventory Report.

FIGURE 3.2b-1. Recreational Designated Use Status for Lakes.



3.2c: Lake Recreational Designated Use: Aesthetics

Many of the lakes in New Jersey are constructed impoundments which are highly prone to eutrophication. Eutrophication occurs naturally as lakes age; however, this process can be accelerated from excessive inputs of nutrients and suspended sediments from the surrounding watershed. Eutrophic lakes are characterized by excessive growth of aquatic weeds and algae, shallow depths as sediments fill the lake, elevated temperatures, and low dissolved oxygen. The excessive algal growth, be it planktonic or rooted, often create aesthetically unpleasant conditions for swimming and difficult conditions for boating.

Details regarding the assessment methods applied to lakes experiencing nuisance algal growth in the context of the Integrated List are contained in section 5.3 of the Methods Manual. The Clean Lakes Program was designed by USEPA to facilitate identification and remediation of impaired lakes. Much of the impairments brought to the Department's attention through the Clean Lakes Program centered around nuisance algal growth impairing swimming and in some cases boating. The Program has assessed a total of 117 public lakes, representing 10,462 acres. This represents 31% of public lakes and 44% of public lake acres. Many Clean Lakes assessments had been performed in the 1980s and early 1990s.

Prior to the 2000 Water Quality Inventory Report, lake trophic assessments had been used to assess lake Aquatic Life Designated Use Support. Beginning in the 2000 Report, Aquatic Life Designated Use Support in lakes was based instead upon warm water fishery assessments supplied by the Department's Bureau of Freshwater Fisheries (BFF). This 2002 Report continues this method of assessment.

Clean Lakes Program Eutrophication Assessment Results

Table 3.2c delineates the results of classifying Clean Lakes Program Eutrophication Assessment results to the Integrated List. Of 117 public lakes assessed by the Program, 115 are located on the Department’s GIS system. An additional 2 lakes (Foxmill Lake in Salem County and Mac’s Pond in Monmouth County) were reported to the Department; however, because they are not indexed within the GIS system, their acreages are currently unknown and they are not included in the calculations of acres within each of the use support categories.

Of the 115 lakes on the GIS system, 4 lakes (249 acres) were assessed as mesotrophic: Lake Atsion, Tuckahoe Lake, Manahawken Lake, and Turnmill Lake. The remaining 111 lakes were assessed as eutrophic. Within the context of the 2002 Integrated List, the results are delineated on Table 3.2c below.

Table 3.2c: Clean Lakes Program Eutrophication Assessment Results Applied to the Integrated List

Assessment Use Support Status	Number of Lakes*	Lake Acres	Sublist
Full Support	4	249	Sublist 1
Insufficient Data**	61**	4,064**	Sublist 3**
TMDL Completed	3	54	Sublist 4
Non Support	47	5,775	Sublist 5
Total Assessed	**115**	**10,142**	

* Lake acres are based upon lakes indexed within the Department's Geographic Information System (GIS) only. An additional 2 lakes were reported to the Department, however, because they are not indexed within the GIS system, their acreages are currently unknown and they are not included in the calculations of acres within each of the use support categories. These lakes are Foxmill Lake in Salem County and Mac's Pond in Monmouth County.

**Lakes assigned to Sublist 3 represent lakes assessed as eutrophic, however no recreational use impairment has been reported to the Department. See section 5.3 of the Methods Manual.

Subsequently, extensive remediation and a TMDL were completed for Upper and Lower Sylvan Lake and Strawbridge Lake (all in Burlington County) resulting in these lakes being listed on Sublist 4a (TMDL completed). For additional information regarding the status of restoration efforts for lakes assessed under the Clean Lakes Program, readers are referred to the New Jersey 2000 305(b) report, specifically tables A4.3.3-1 and A4.3.3-2 within the Appendix of the Lake Assessment section.

Lake Eutrophication Source and Cause Assessment

Much of the Department's information regarding lake eutrophication comes from the Clean Lakes Program. As reported in earlier Water Quality Inventory Reports, lake eutrophication is a widespread issue in New Jersey and is characterized by elevated levels of suspended sediment, nutrient and algal concentrations. Aquatic life may be stressed due to dissolved oxygen fluctuations and in extreme situations, fish kills may occur. Eutrophic conditions generally lower the aesthetic and recreational value of the lake. Although all lakes naturally progress to eutrophic conditions, then become wetlands (especially those created as stream impoundments), this process is being accelerated by excessive inputs of nutrients and suspended sediments from point and nonpoint sources. In addition, an important factor to consider is most New Jersey lakes are shallow stream impoundments constructed for purposes including flood and sediment control. These shallow impoundments are highly prone to eutrophication. Through restoration projects, described immediately below, site-specific sources of nutrients and suspended sediment as well as management measures are identified for each lake.

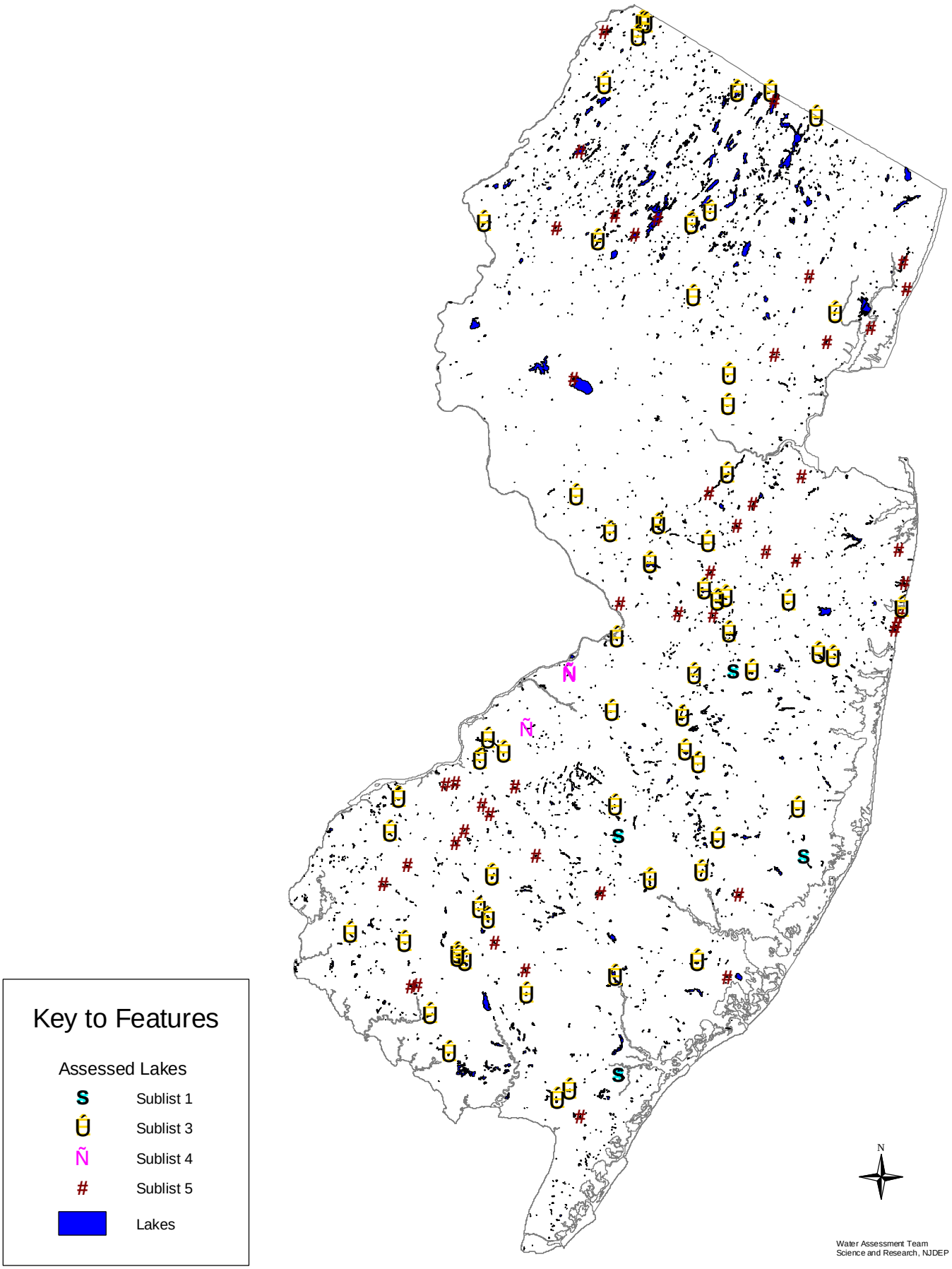
Strategies to Protect and Enhance the Aesthetic Aspects of Swimming and Boating

Implement improvement projects in impaired lakes: New Jersey has traditionally used Clean Lakes Program funds to address eutrophication in lakes. More recently, the $5 million Lakes Bond Act has been used to begin additional projects. The New Jersey Environmental Infrastructure Trust fund was used to address water quality and sedimentation issues in Colonial

Lake in Mercer County. USEPA no longer funds the Clean Lakes Program and is recommending that states use section 319(h) funds for lake remediation, with the assumption that the impairments are due (largely if not exclusively) to non point sources.

Develop TMDLs for impaired lakes: Many eutrophic lakes identified by the Clean Lakes Program are included on Sublist 5 of the 2002 Integrated List Impaired Waterbodies List. Thus these lakes are subject to the provisions and schedules of a TMDL. As TMDLs are developed, nutrient and sediment loads and cycling in the lakes will be assessed and management measures will be prioritized and implemented. To date, of the 48 eutrophic lakes listed on Sublist 5, 35 are priority lakes for TMDLs.

FIGURE 3.2c-1. Aesthetic Designated Use Status for Lakes.



Section 3.3: Estuary and Coastal Assessment

Section 3.3a: Estuary and Ocean Aquatic Life Assessment

New Jersey's estuaries provide a rich spawning ground for many aquatic species. These species are important for recreational and commercial fishing and shellfishing, as well as important components of the aquatic ecosystem.

Various programs within the New Jersey Department of Environmental Protection (NJDEP) have oversight for protecting coastal environments (e.g., water quality, fin- and shellfisheries, bathing beaches, land use permitting, etc.); management planning (e.g., Coastal Zone Management, Wastewater) and public policy implementation (e.g., Coastal Areas Facility Review Act). These programs and descriptions of their activities can be found at NJDEP's Website (www.state.nj.us/dep/). In addition, NJDEP participates in a number of multi-state, estuarine management programs such as the Interstate Environmental Commission (IEC) formerly the Interstate Sanitation Commission, the Delaware River Basin Commission (DRBC) and three National Estuary Programs (i.e., NY/NJ Harbor Estuary and NY Bight Restoration Plan, Delaware Estuary Program, and Barnegat Bay Estuary Program).

New Jersey's estuarine waters are assessed in conjunction with two interstate agencies, the Interstate Environmental Commission (IEC) and the Delaware River Basin Commission (DRBC). New Jersey assesses and reports on the estuarine waters within the southern half of Raritan Bay, Sandy Hook Bay and the back-bay waters from the Navesink estuary south to the eastern tip of Cape May. The IEC assesses and reports on the waters in the New York/New Jersey Harbor, specifically the northern portion of Raritan Bay, Newark Bay, the Arthur Kill and Kill Van Kull, Upper New York Bay and the Lower Hudson River. The DRBC assesses and reports on the Delaware River and Bay. This New Jersey Water Quality Inventory Report does not include the observations and assessments published by the IEC or DRBC, except for the delisting of sites from the 1998 303(d) List. For information regarding waters overseen by these two interstate agencies, please refer to the corresponding addresses provided in the front of this report.

Estuarine Aquatic Life Assessment Method

The Department does not currently directly assess the condition of the coastal marine biota in order to assess the Aquatic Life Designated Use in these waters. Instead, the Department uses dissolved oxygen (DO) measurements as an indicator for this designated use status. Dissolved oxygen is necessary for almost all forms of aquatic life and monitoring data are readily available. There are limitations to this assessment tool, however, because many open water aquatic species are mobile and/or naturally tolerant of transient low DO occurrences. In order to obtain a clearer assessment of coastal biotic communities, additional data and assessments will be needed in the future to improve this assessment.

Methods employed by the Department in assessing Aquatic Life Designated use support in both estuary and ocean waters are described in section 5.1.3 of the Methods Document. The monitoring programs supplying data employed in these assessments are described in Appendix II of the Document. Estuarine waters are reported separately as open estuarine water and as tidal river miles in this report.

Estuary Aquatic Life Assessment Results

Of the 258 square miles of open estuarine waters assessed from southern Raritan Bay south to Cape May, 67% had sufficient dissolved oxygen levels to support a healthy biota. The remaining 33 % were assessed as being in non attainment due to periodic drops in DO levels to unacceptable levels. Locations where DO violations were observed centered around the Shark River, Lower Manasquan River, Great Bay, Absecon and Lakes Bay, Sculls Bay, and Great Egg Harbor Inlet (see Fig. 3.3a-2).

Of the 95 miles of tidal rivers assessed, 76 miles (80%) were assessed to be in full attainment, 19 miles were in non attainment (20%). Areas of non-support included tidal portions of the Shark River and Jumping Brook, tidal Patcong Creek and the Middle River within the Great Egg Harbor River watershed, and the lower tidal portions of the Maurice River (see Fig. 3.3a-2).

Table 3.3a-1: Open Water Estuary Aquatic Life Assessment Results

Use Support Category	Monitored Square Miles	Percent	Integrated List
Full Support	173	67 %	Sublist 1
Insufficient Data	0		Sublist 3
No Support	85	33 %	Sublist 5
Total	**258**	**100%**	

Table 3.3a-2: Tidal River Aquatic Life Assessment Results

Use Support Category	Monitored River Miles	Percent	Integrated List
Full Support	76	80%	Sublist 1
Insufficient Data	0	NA	Sublist 3
No Support	19	20%	Sublist 5
Total	**95**	**100%**	

Estuary Aquatic Life Source and Cause Assessment

Factors contributing to low dissolved oxygen concentrations in New Jersey estuaries are discussed in Zimmer and Groppenbacher (1999) and are both natural and anthropogenic. Estuarine DO levels are characteristically lowest in summer, when water is warm and biological activity is at its highest. Many of the estuaries along the New Jersey coast are shallow waterbodies, often with poor mixing which contributes to the warming of the waters in summer that in turn contribute to low oxygen levels. An additional contributing factor to low DO is input of naturally oxygen depleted waters from adjacent wetlands especially during ebb tides.

Recorded low DO conditions have often been found to coincide with phytoplankton bloom die-off, the resulting decay of which contributes to water column oxygen consumption during the bloom die-off phase. Anthropogenic inputs of nutrients have contributed to elevated nutrient levels that are believed to contribute to periodic phytoplankton blooms.

Anthropogenic inputs include nonpoint sources such as:

- surface runoff from agricultural and developed lands, transported by direct stormwater discharges and tributary inputs;
- direct ground water inputs of nitrogen from historical deposition;
- wet and dry atmospheric deposition of nitrogen oxide emissions, primarily from fossil fuel combustion (Jaworski, et. al. 1997) which in the Barnegat Bay has been estimated to represent a substantial nitrogen load (USGS, written communication, 8 August 2000); and
- other sources such as large waterfowl populations and sediment resuspension through boat-created turbulence.

In addition, NJDEP recognizes that multi-media approaches to environmental assessment and management are best when dealing with contaminants that may be transported through differing media. Understanding the effects of air deposition and other non-point sources of pollution to coastal waters, including contaminant composition and magnitude of potential load, is critical to scientists and policy makers in formulating watershed-based management strategies and regional solutions to environmental issues. Recent investigations (Jaworski et. al. 1997) have estimated that for ten benchmark watersheds in the United States, including the Hudson and Delaware Basins on either side of New Jersey, the riverine nitrogen fluxes of nitrogen were highly correlated with atmospheric deposition onto their landscapes and also with nitrogen oxide emissions from their airsheds. More locally, a study of Barnegat Bay in New Jersey, a typical shallow Atlantic coast embayment, indicated that over 75% of the nitrogen input to the bay is from atmospheric deposition (Seitzinger and Sanders 1999).

To address these multi-media concerns, NJDEP has established the statewide New Jersey Atmospheric Deposition Network (NJADN) which samples gaseous, particulate, and precipitation concentrations of a number of contaminants at nine sites throughout the State. The NJADN, through the collection of data that address wet and dry deposition and air-water exchange of atmospheric pollutants, will provide estimates of direct loadings to surface waters. Such data will be especially important for aquatic systems that have large surface areas relative to watershed areas, such as coastal areas. Preliminary findings of the NJADN are available for a number of pollutants. Findings for nitrate confirm earlier estimates that air deposition of nitrogen may be significant for some watersheds. The annual wet deposition of nitrate throughout the State, as measured by the NJADN, ranged from 22 to 30 mmol/m^2/yr (Eisenreich & Reinfelder, 2001). With the assumption that nitrate represents roughly half of the total dissolved nitrogen in rain (with the remainder either ammonium or dissolved organic nitrogen), average total nitrogen fluxes to terrestrial areas and coastal waters of the State are approximately 0.7 gram/m^2/yr.

Ocean Water Aquatic Life Assessment Methods

As stated previously, methods employed by the Department in assessing Aquatic Life Designated use support in both estuary and ocean waters are described in section 5.1.3 of the Methods Document. The monitoring programs supplying data employed in these assessments are described in Appendix II of the Document. Aquatic life assessment for ocean waters in New Jersey is based upon water column dissolved oxygen (DO) levels recorded by the USEPA helicopter during June through September, 1996 through 2001. Samples are taken at one meter below the water surface (terminated in 1999) and one meter off the ocean bottom, depths ranged from 20 to 75 meters. EPA terminated surface water sampling for DO in 1999 when historic records showed surface DO to be consistently acceptable in the locations sampled. Because the data supporting the Aquatic Life Designated use assessment here are 5 years old or less, they are regarded as monitored.

Ocean Water Aquatic Life Assessment Results

Of 454 square (statute*) miles assessed (Sandy Hook south to Cape May and out 3 nautical* miles) 30 percent (136 sq. statute mi.) fully support (Sublist 1) the Aquatic Life Use and the remaining 70 percent (318 sq. statute mi.) are in nonattainment (Sublist 5) due to a benthic low DO cell which forms off the coast during the summer months and breaks up in the fall. It is important to note that surface DO based upon historic monitoring by the EPA helicopter has found the DO in the surface regions of the waters listed on sublist 5 to be consistently acceptable. The areas of full support are centered approximately one mile off the coast from Barnegat Inlet, Absecon Inlet and a three mile eastward transect just above Hereford Inlet. [Is a map available or possible?]

Table 3.3a-3: Ocean Aquatic Life Assessment Results

Use Support Status	Square Miles	Percent of Assessed Waters	Integrated List
Full Attainment	136	30%	Sublist 1
Insufficient Data	0		Sublist 3
Non Attainment	318	70*****%	Sublist 5
Total	**454**	**100%**	

*** Applies to ocean floor only.**

Some important considerations associated with these assessment results include:

Low DO occurred on the ocean bottom: When assessing data for the 2000 Inventory Report DEP observed that EPA data reveal that DO readings collected at one meter below the surface indicate acceptable DO and almost all exceedances of criteria were recorded on the ocean bottom (one meter off the bottom). A subsequent review of historical data by EPA Region II has confirmed this. This is not consistent with samples collected by EPA of some near shore surface waters for NJDEP's Estuarine Monitoring Program. These samples showed that subsurface DO

* Statute mile equals 5280 feet; a nautical mile is 6080 feet.

violations in near shore waters were occurring within the last 5 years[1]. Additional data within the water column are needed to characterize the volume of the low DO cells.

Low DO occurrences in the ocean were transient: USEPA personnel indicated that based on experience, the regions exhibiting low DO are transient, forming during the summer months and disappearing during the fall turnover and not forming again until the following summer when the waters re-stratify (Randy Braun, personal communication).

The biological impacts on the ocean floor are not known: DO concentrations provide an surrogate indicator of aquatic life designated use attainment and does not provide an assessment of actual biological conditions. In open waters, fish can avoid areas with low DO, and many crustaceans and other benthic inhabitants are naturally tolerant of temporary low DO conditions. The Department does not have data to characterize the status of the benthic community in these waters, therefore, the significance of temporary DO conditions below 5 mg/l to aquatic life uses is unclear.

The Department has seen evidence of extensive benthic mortality (e.g. shellfish) following the die-off of a massive region-wide marine algae (dinoflagellate) bloom in 1976. Other than this single isolated event, evidence of extensive benthic mortality has not been observed by the Department or EPA since EPA began monitoring ocean DO in the mid-1970's.

Clearly, biological data such as assessments of benthic invertebrate populations and the presence of recorded fish-kills would enhance this assessment.

The Department lacks both annual and diurnal data: USEPA data used for this assessment were collected during the most stressful period of the year (June through August) when DO levels are lowest, and as such, are not gathered to specifically assess the attainment of aquatic life designated uses year-round. In addition, night-time DO data would show how low DO goes, indicating how stressful the 24-hour cycle might be in these waters.

Additional information that would aid in clarifying the aquatic life status and better characterizing the DO status in the benthic waters are listed below:

- A characterization of the benthic biota (direct biological monitoring) for indications of impairment from inadequate DO.
- Additional DO data to characterize diurnal and seasonal fluxes as well as vertical DO conditions within the water column. Characterization of diurnal DO fluxes could be accomplished through deployment of continuous water quality monitoring equipment.
- Nutrient data, concentrating on nitrogen and oxidation-demanding substances both within and flowing into the ocean area in question to characterize the sources of loadings to these waters.
- Water quality modeling to determine the significance of anthropogenic loading to coastal waters and their contributions to benthic DO recordings below 5 mg/l.

For additional recommendations and information regarding the management of coastal waters

[1] Dataset available at www.state.nj.us/dep/wmm/bmw

see "Maintaining and Improving Aquatic Life in Coastal Waters," below.

Coastal Aquatic Life Source and Cause Assessment

Occurrences of low DO in the ocean has been attributed to a combination of natural processes and anthropogenic inputs of nutrients. Ocean waters naturally stratify as they warm in the summer. As phytoplankton bloom and die during the summer, natural biological activity decomposes the algae which in turn reduces DO levels near the ocean floor. The rate, timing and extent of phytoplankton cycles may be worsened by nutrient inputs from near shore waters.

USEPA (1999) attributed the low DO in the near shore waters to the oxygen demand created by river inputs, offshore sewerage treatment plant inputs (there are 15 outfalls in the New Jersey coastal waters), stormwater runoff and the influence of the plume from the Hudson/Raritan River estuary system. Atmospheric contributions to nutrient enrichment occur in the ocean but, in contrast to estuaries, their relative significance appears to be minor when contrasted to other inputs (NY-NJ Harbor Estuary Program, 1996).

Maintaining and Improving Aquatic Life in Coastal Waters

Improve the basis for aquatic life assessments: Additional biological datasets will be explored and, as appropriate, integrated into future assessments of aquatic life in coastal waters. Major datasets include: fish and shellfish population data collected by the Division of Fish and Wildlife and other entities; ocean biological monitoring performed in the vicinity of the 15 ocean STP outfalls through NJPDES permits; and chlorophyll a data collected via remote sensing. Data regarding possible fish kills would also be helpful.

Continue to monitor and assess air deposition of nutrients to coastal waters: NJDEP operates an Air Deposition Monitoring Network that includes nutrient data collection. This network is expected to provide important data related to nutrient fluxes to estuarine and ocean waters from air deposition. These nutrient fluxes, in addition to land based sources, may play an important role in algal blooms in these waters that contribute to episodes of low DO.

Manage nutrient loads to coastal waters: As appropriate, based on the assessments above, additional measures to manage nutrient loads to coastal waters may be needed. It is important to observe that pollution sources influencing ocean impairment are interstate in nature and their remediation is also. Management measures within the waters discussed here must be the responsibility of New Jersey, New York City and New York State. A nutrient Total Maximum Daily Load (TMDL) analysis is being planned through the New York-New Jersey Harbor Estuary Program to address the contributions from the Hudson-Raritan River Estuary system.

FIGURE 3.3a-1. Monitoring Network for Aquatic Life Designated Use.

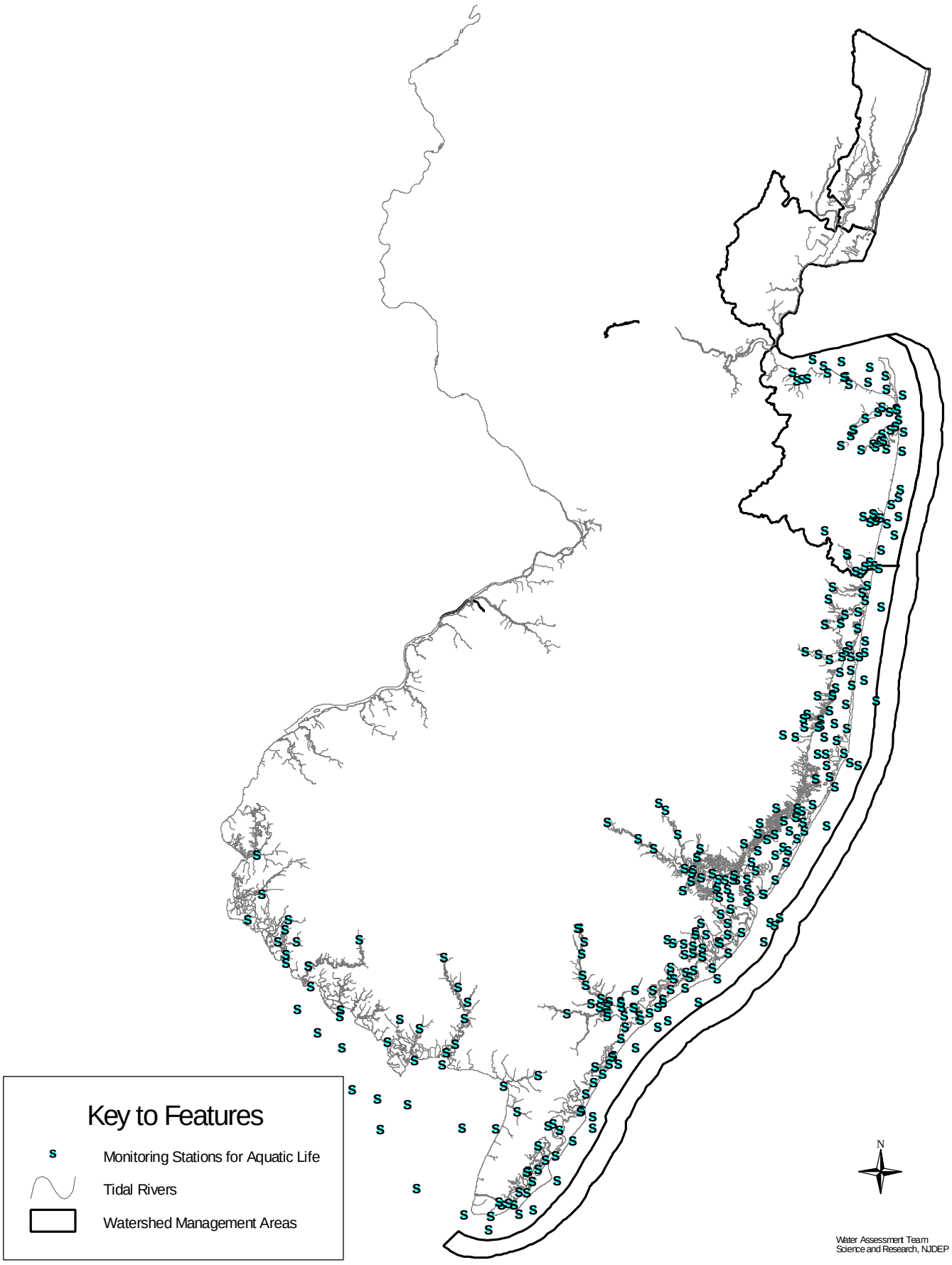
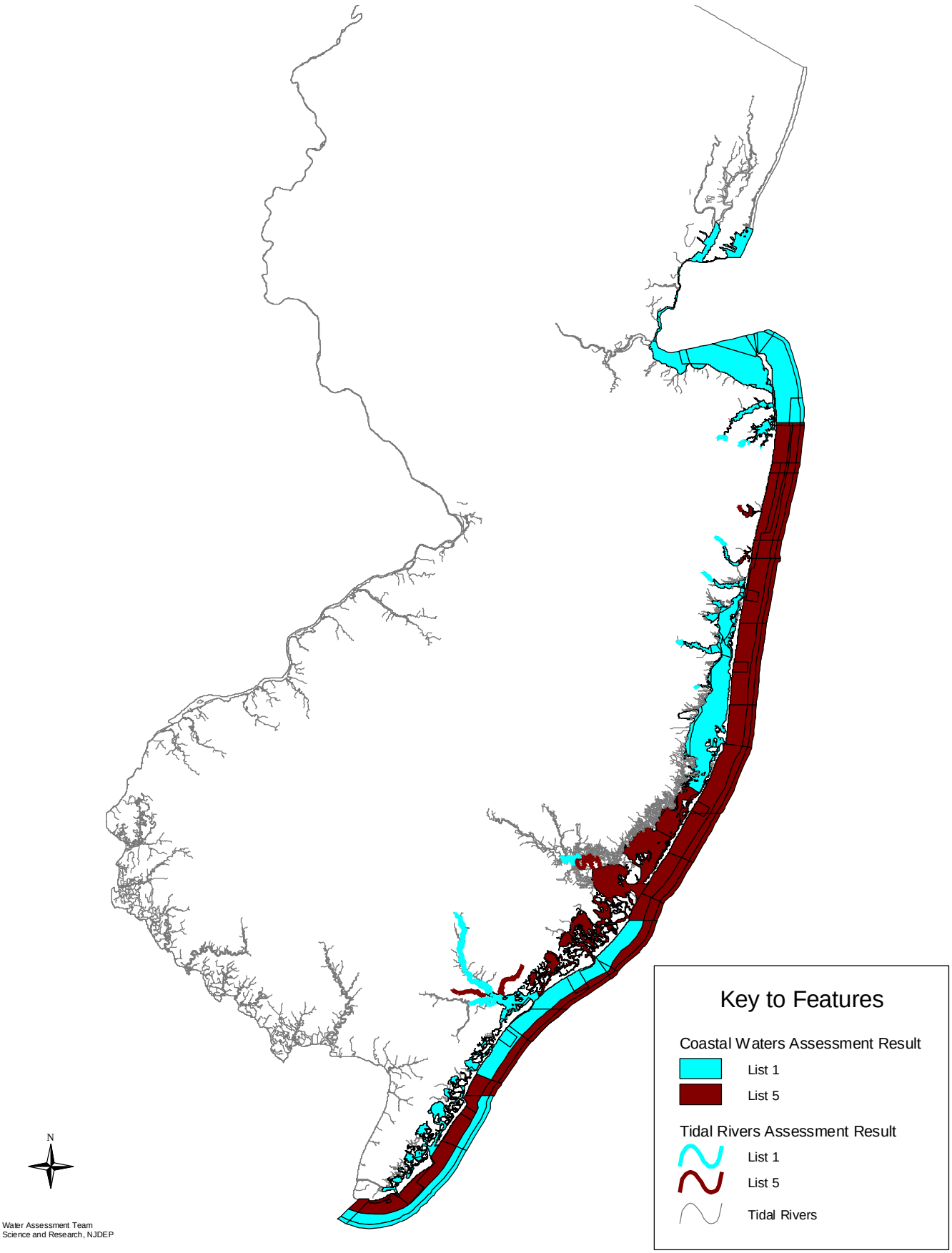


FIGURE 3.3a-2. Aquatic Life Assessment Status for Coastal Waters and Tidal Rivers. Note: Ocean waters on Sublist 5 are limited to the ocean floor only.



Section 3.3b: Estuarine and Coastal Recreational Designated Use Assessment

New Jersey's coastal beaches and waterways are very intensely used for recreational purposes. This resource includes 138 bay monitoring stations covering about 4 miles and 179 ocean stations covering 127 miles. In addition, 264.3 square miles of tidal estuarine rivers and shallow back bays form an inner-coastal estuarine network (Fig. 3.3b-1). New Jersey's ocean jurisdiction extends to 3 nautical miles off-shore equating to 446 square miles. Ocean and bay resources are widely used for swimming, boating, commercial and recreational fishing and shellfish harvest. Thus, there are ample opportunities for direct contact with these waters and high sanitary quality is very important for protection of public health, economics and enjoyment of this valuable resource.

Estuarine and Coastal Recreational Designated Use Assessment Method

Descriptions regarding the assessments of recreational designated use supports for coastal waters are contained in section 5.2 of the Methods Manual. Additional information regarding monitoring programs which provide data supporting these assessments are contained in Appendix II of the Manual.

Recreational designated use attainment was assessed using several datasets:

- Cooperative Coastal Monitoring Program beach closure data from over 6000 samples collected each between 1997 and 2000 were used to assess recreational uses at designated ocean and bay bathing beaches. Data are managed in an in-house database.

- Marine and Coastal Water Quality Monitoring Program fecal coliform data from over 600 samples collected between 1995 and 1997, inclusive, were used to assess recreational use attainment in tidal rivers and estuaries. Data are managed in USEPA's STORET database. This report is available from the NJDEP website: www.state.nj.us/dep.

- USEPA Ocean Monitoring included collection of fecal coliform data from 44 stations, sampled 7-14 times per year; 452 samples were collected in 1997 and 547 samples were collected in 1998. (USEPA, 1999). These data and an assessment of ocean pollution sources were used to assess recreational use attainment in the ocean.

Spatial Extent of Assessment of ocean and estuarine waters: 138 back bay beaches estimated to be 150 feet long (beachfront) x 100 feet wide (3.9 square miles); 127 miles of ocean beaches estimated to be 150 feet wide

Estuarine and Coastal Recreational Designated Use Assessment Result

Estuarine Waters

Note, this assessment is the same as the 2000 assessment; these waters have not been reassessed for the 2002 Integrated List. The square miles, however will be different because the tidal rivers have been presented as a separate assessment in this 2002 report, while they were combined with the open estuary mileage's in the 2000 Report.

As with the Aquatic Life Designated Use results reported above, estuarine waters are reported separately as open estuarine water and as tidal river miles in this section. Of 268 square miles assessed of open estuarine waters (from the tip of Sandy Hook to the tip of Cape May), 94% (252 sq. miles) fully met recreational uses and 1% (2.1 sq. miles) did not support recreational uses between 1995 and 1997 (Table 3.3b-1). A remaining 5% (14 sq. miles) did not have sufficient data necessary to make an assessment (Sublist 3). The region of nonsupport was in the Maurice River and Cove.

Of the 97 miles of tidal rivers assessed (Table 3.3b-2), 53 miles (55%) were assessed to be in full attainment, 44 miles were in non attainment (45%). Areas of non-support included Matawan, Waackaack, Chingarora and Luppatatong Creeks, all tributaries to the Raritan Bay; and the lower Maurice River (see Fig. 3.3b-1).

As discussed in the Report on Marine and Coastal Water Quality, 1993-1997, levels of FC above background indicate the presence of FC sources in several waterbodies. (Zimmer and Groppenbacher, 1999). Additional work is needed to assess trends in FC concentrations and to evaluate potential threats to designated use attainment in these waterbodies.

Table 3.3b-1: Open Water Estuary Recreational Use Assessment Results

Use Support Status	Monitored Square Miles	Percent	Integrated List
Full Attainment	252	94%	Sublist 1
Insufficient Data	14	5%	Sublist 3
Non Attainment	2	1%	Sublist 5
Total	**268**	**100%**	

Table 3.3b-2: Tidal River Estuary Recreational Use Assessment Results

Use Support Status	Monitored River Miles	Percent	Integrated List
Full Attainment	53	55%	Sublist 1
Insufficient Data	0	NA	Sublist 3
Non Attainment	44	45%	Sublist 5
Total	**97**	**100%**	

Spatial Extent of Assessment for Estuarine Waters: Tidal rivers and back bays from Raritan Bay to the tip of Cape May and Maurice River and Cove (269 square miles). Raritan Bay was included because recreational uses were not assessed in the Interstate Sanitation Commission's 2000 Water Quality Inventory Report; Delaware Bay was not included because recreational uses were assessed in the Delaware River Basin Commission's 2000 Water Quality Inventory Report.

Table 3.3b-2: Ocean Recreational Use Assessment Results

Use Support Status	Monitored Square Miles*	Percent	Integrated List
Full Attainment	446	100%	Sublist 1
Insufficient Data	0	NA	Sublist 3
Non Attainment	0	NA	Sublist 5
Total	**446**	**100%**	

* Square miles are based upon the miles of linear coast line (Sandy Hook to Cape May) and out 3 nautical miles off-shore.

Ocean Waters

As shown on Table 3.3b-2, recreational designated uses were fully met in all ocean waters. A review of pollution sources did not identify any significant threats to sanitary quality in ocean waters. Thus of 446 square miles assessed, 100% fully met recreational designated uses between 1998 and 1999.

Estuarine and Coastal Recreational Designated Use Source and Cause Assessment

Although recreational designated uses were largely met in NJ estuarine and ocean waters, localized problems occur. The following provides a qualitative assessment of the sources fecal coliform where levels are above background levels.

Sources of FC that may affect NJ estuarine and ocean waters include:

- Municipal Stormwater and Runoff – there are over 7000 storm drains that discharge to river and bay estuarine waters. Stormdrains and overland runoff can be a source of FC pollution from pets and other wildlife. More stormdrains are installed each year as coastal areas are developed; runoff increases as impervious areas increase. Through NJ's Sewage Infrastructure Improvement Act Program, cross-connections and inter-connections with sanitary sewer lines have been investigated and largely corrected.

- Wildlife – congregations of seagulls are a suspected source of FC pollution in some areas.

- Sanitary discharges from boats – although boaters are encouraged to use pump-out stations and No Discharge Zones have been established in some areas, some sanitary discharge from boats probably still occurs.

- Municipal Sewage Treatment Plants – There are 15 municipal STPs that discharge to the ocean in NJ. Improvements in estuarine water quality occurred as coastal STPs were

regionalized and upgraded in the 1980's. Although compliance with FC limits is generally very good, localized problems still occur. For example, sewer line blockage closed beaches in Atlantic City 6 times in 1999.

- Transport from Non-tidal Rivers - The sanitary quality of non-tidal rivers is poor, and recreational designated uses are largely not met in these rivers. Sources of FC pollution to non-tidal rivers include municipal stormwater and runoff, combined sewer overflows, sanitary sewer overflows, and wildlife (primarily geese).

- Possible downstream transport of fecal contamination from nontidal waters situated upstream.

- Transport from Lakes – Field investigations have revealed that lake outlets have lead to bathing beach closures.

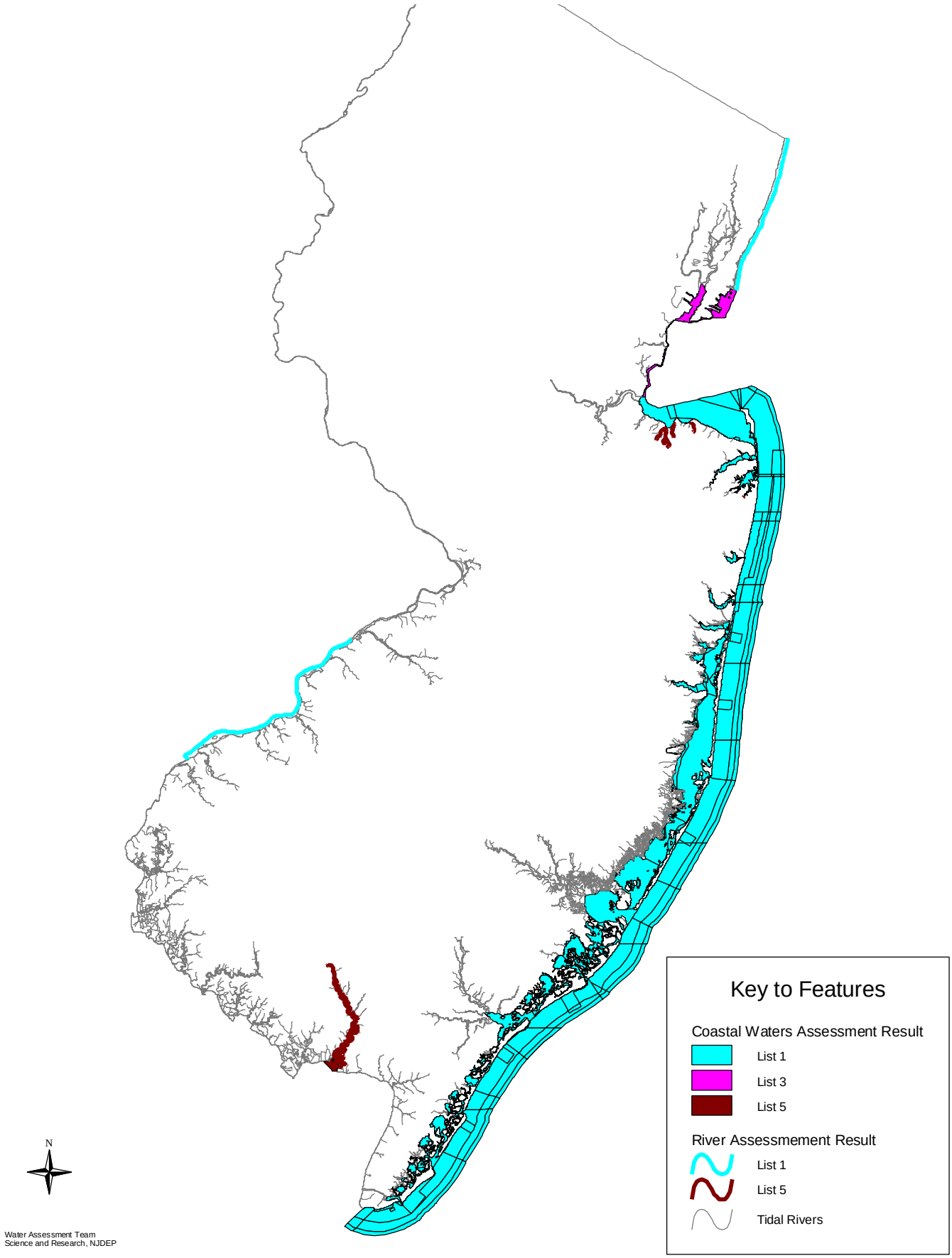
Maintaining and Improving Recreational Designated Use Attainment in Coastal Waters

- The Department will continue to perform aerial surveillance of nearshore coastal waters which enables the routine evaluation of coastal water quality and the assessment of the nature and extent of ocean pollution. Six flights per week, excluding Wednesdays, include Raritan Bay, the Lower New York Bay, and the Atlantic coast from Sandy Hook to Barnegat Inlet. Flights on Thursdays and Sundays are extended to include the area from Barnegat Inlet to Cape May Point.

- As part of the New York-New Jersey Harbor Estuary Program Floatables Action Plan, flight activities are coordinated with the United States Environmental Protection Agency (USEPA) and the United States Army Corps of Engineers' effort to capture floating solid waste and debris, also known as floatables, with water-skimming vessels. Sources of floatables that have affected the State's coastal shores include stormwater outfalls, combined sewer overflows, operational landfills, and illegal dump sites. Surveillance flights continue to record a decrease in the quantity of floatables in the coastal waterways compared to the years prior to 1990.

- Through the development and implementation of TMDLs for FC pollution in rivers that flow to estuaries, reduction of FC from freshwaters is expected. This reduction is expected to have a positive influence on FC concentrations in coastal waters

FIGURE 3.3b-1. Recreational Designated Use Attainment Status in Coastal Waters and Tidal Rivers.



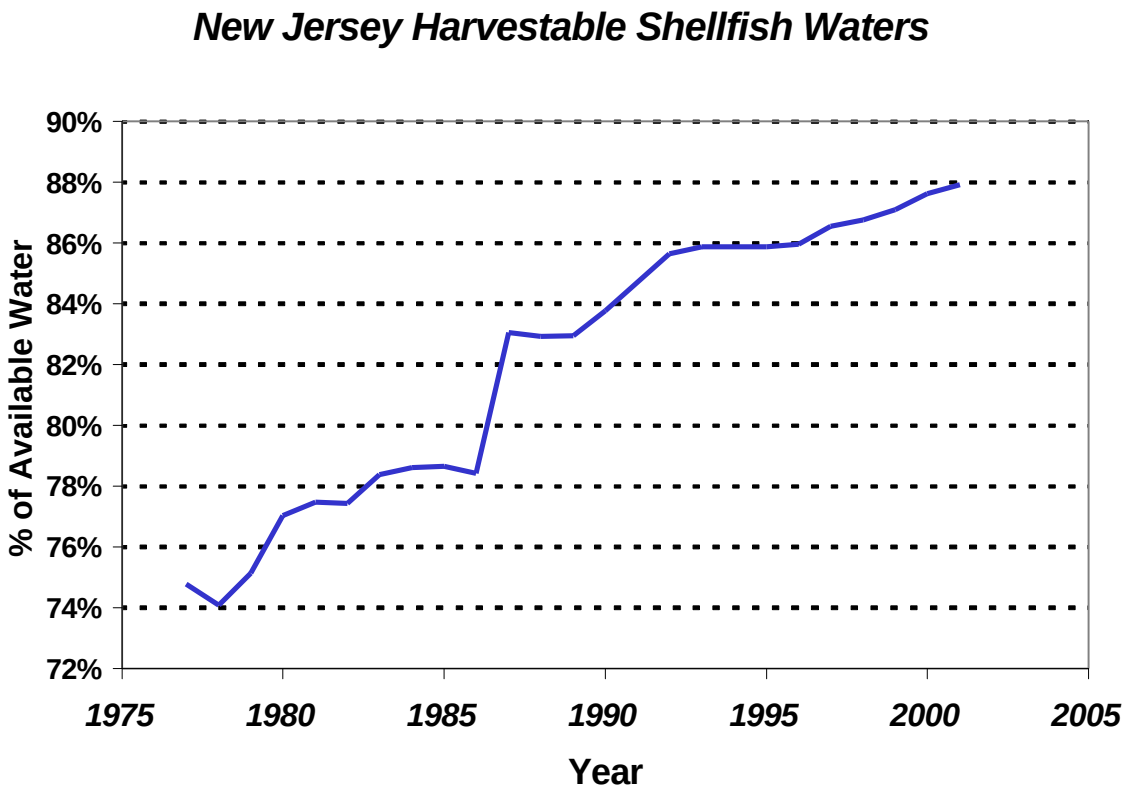
Section 3.3c: Shellfish Consumption Designated Use Assessment

The National Shellfish Sanitation Program (NSSP) collects data on the levels of total coliform in shellfish and waters that are harvested for shellfish. These data were used to develop the shellfish consumption portion of the fish and shellfish consumption designated use assessment. This network has not changed since the 1996 Water Quality Inventory Report.

The Department monitors the sanitary quality of estuarine and ocean waters by observing measurements of coliform bacterial concentrations (indicators of the presence of pathogens) in the water column and uses the results to classify bay, estuarine, and ocean waters for shellfish harvesting. The data are analyzed for compliance with federal standards. In addition, shoreline surveys and hydrographic tracing are performed to identify pollution sources. Monitoring is focused on areas with the potential for a harvestable shellfish resource. Details of the assessment methodology are outlined in Section 5.5 of the Methods Document.

New Jersey has been a national leader in maintaining and enhancing waters available for shellfish harvest. The shellfish waters that support harvesting have increased from 75% in 1977, to 87% in 1998 and 88% in 2000. (See Figure 3.3c-1).

Figure 3.3c-1. New Jersey Harvestable Shellfish Waters.



One of the major differences between the 1998 303(d) List and the 2002 List is that waterbodies designated as prohibited solely for administrative purposes are no longer automatically labeled impaired. Where existing surface water quality data exists, the actual water quality is used for the assessment. If no data exists then the waterbody is unassessed. For the 2002 Integrated List, areas around sewage treatment plants discharging to the ocean and designated as areas prohibited for the harvest of shellfish as a precautionary measure are listed as Full Attainment. Approximately 21 square miles have been removed from the Impaired List for this reason.

During the next listing cycle, the Department will continue to evaluate other administratively closed areas such as lagoons and docks. Tables 3.3c-1, 3.3c-2 and 3.3c-3 below summarize the assessment results for open water (ocean), back bay and tidal rivers, respectively. It should be noted that the results for the ocean and back bay areas are calculated in square miles while the tidal river assessment is calculated in river miles

Table 3.3c-1: Open Water Estuary Shellfish Consumption Designated Use Results

NSSP Classification	Monitored Square Miles	Percent	Integrated List
Approved or Administrative Prohibited with data showing compliance with SWQS	393	86%	Sublist 1
Non attaining, no TMDL needed	<1	<1%	Sublist 4
Prohibited with data showing non compliance with SWQS or Special Restricted or Seasonal	60	13%	Sublist 5
Prohibited with no data	<1	<1%	Sublist 3
Total Miles	453		

Table 3.3c-2: Back Bay Estuary Shellfish Consumption Designated Use Results

NSSP Classification	Monitored Square Miles	Percent	Integrated List
Approved or Administrative Prohibited with data showing compliance with SWQS	434	73%	Sublist 1
Prohibited with data showing non compliance with SWQS or Special Restricted or Seasonal	135	22%	Sublist 5
Prohibited with no data	30	2%	Sublist 3
Total Miles	599		

Table 3.3c-3: Tidal River Estuary Shellfish Consumption Designated Use Results

NSSP Classification	Monitored River Miles	Percent	Integrated List
Approved or Administrative Prohibited with data showing compliance with SWQS	29.488	3%	Sublist 1
Prohibited with data showing non compliance with SWQS or Special Restricted or Seasonal	858.319	97%	Sublist 5
Prohibited with no data	0		Sublist 3
Total	887.807	100%	

Shellfish Consumption Source and Cause Assessment

As part of *The 1995 National Shellfish Register* (NOAA 1997) NJDEP's Bureau of Marine Water Monitoring supplied information to NOAA on individual shellfish growing areas within state jurisdictional waters. They were also asked to identify the presence of twelve different sources of pollution including agricultural feedlots and Marinas grouped into three broader categories: point, nonpoint and upstream sources. In estuarine waters, marinas, boating, urban runoff and stormwater were identified as major contributing factors impacting shellfish. In Offshore/Ocean waters, direct discharges from ocean outfalls may present localized impacts and nonpoint source urban runoff continues to have a negative impact.

There has been a trend toward general improvement in water quality in the estuaries since the domestic waste discharges were relocated to offshore areas. In addition, many previously unsewered areas have become sewered. There are still a few isolated instances where water quality is still adversely affected by input of inadequately treated domestic waste. Repeated overflows and bypasses from the Monmouth County Bayshore Outfall Authority in northern Monmouth County resulted in the prohibition of harvesting in the western portion of Raritan Bay which had previously allowed harvesting after treatment at a depuration facility or planting on a relay lot. A pump station in Margate has also had frequent problems with overflows.

Marinas have been identified as potentially affecting the suitability of shellfish growing areas. All confines of a marina are automatically designated as *Prohibited*. A buffer area may also be included in the *Prohibited* classification accounting for the size of the marina and the size of the boats. This is a precautionary measure similar to the buffer around sewage outfalls.

Recreational activities may also have a seasonal impact on these waters. In 1997, "No Discharge Zones" under the Clean Vessels Act were instituted in some areas such as the Manasquan River. The discharging of human waste from boats into the estuary/bays in these areas is prohibited. These requirements are expected to facilitate further improvements in water quality in the estuaries.

FIGURE 3.3c-1. Shellfish Monitoring Network.

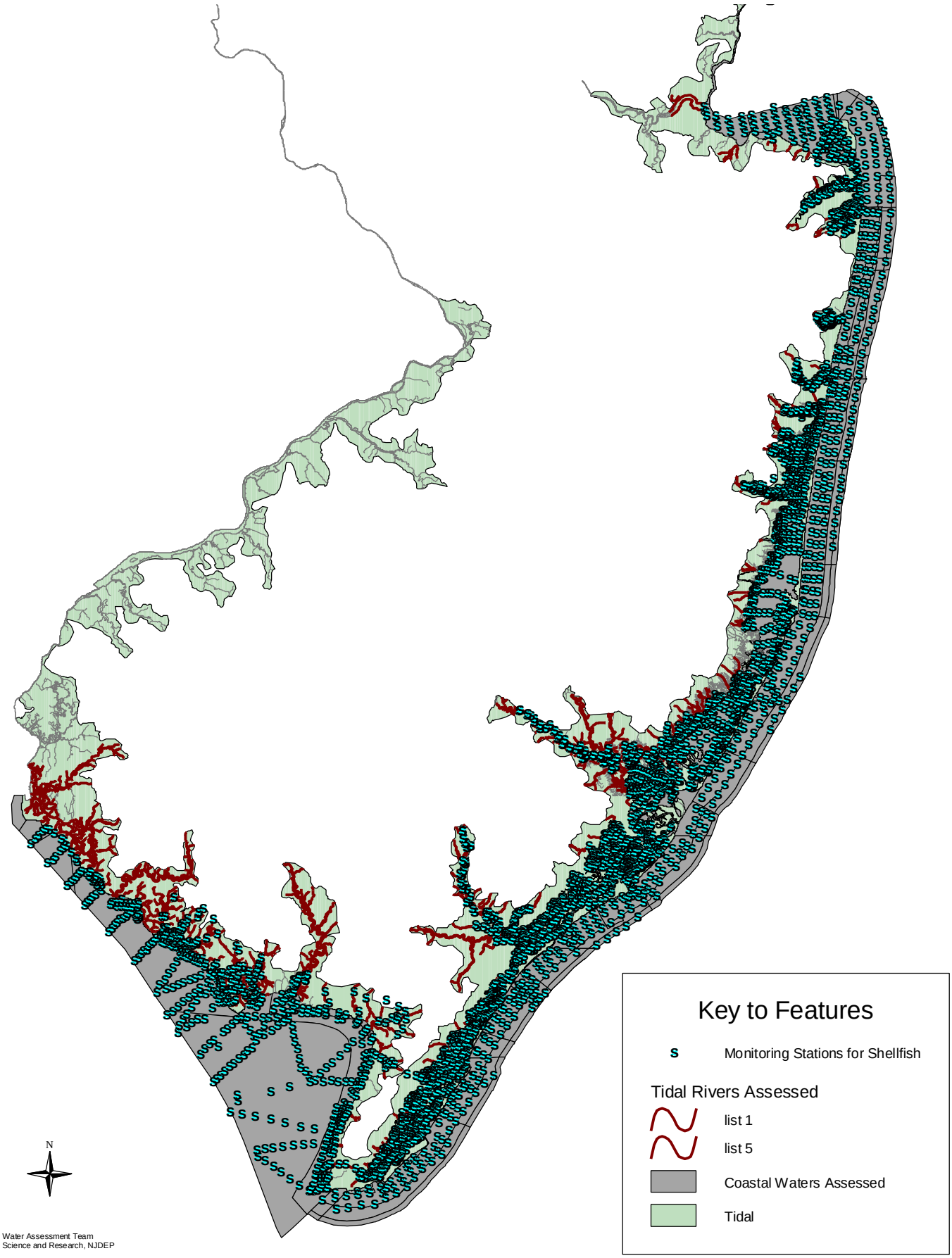
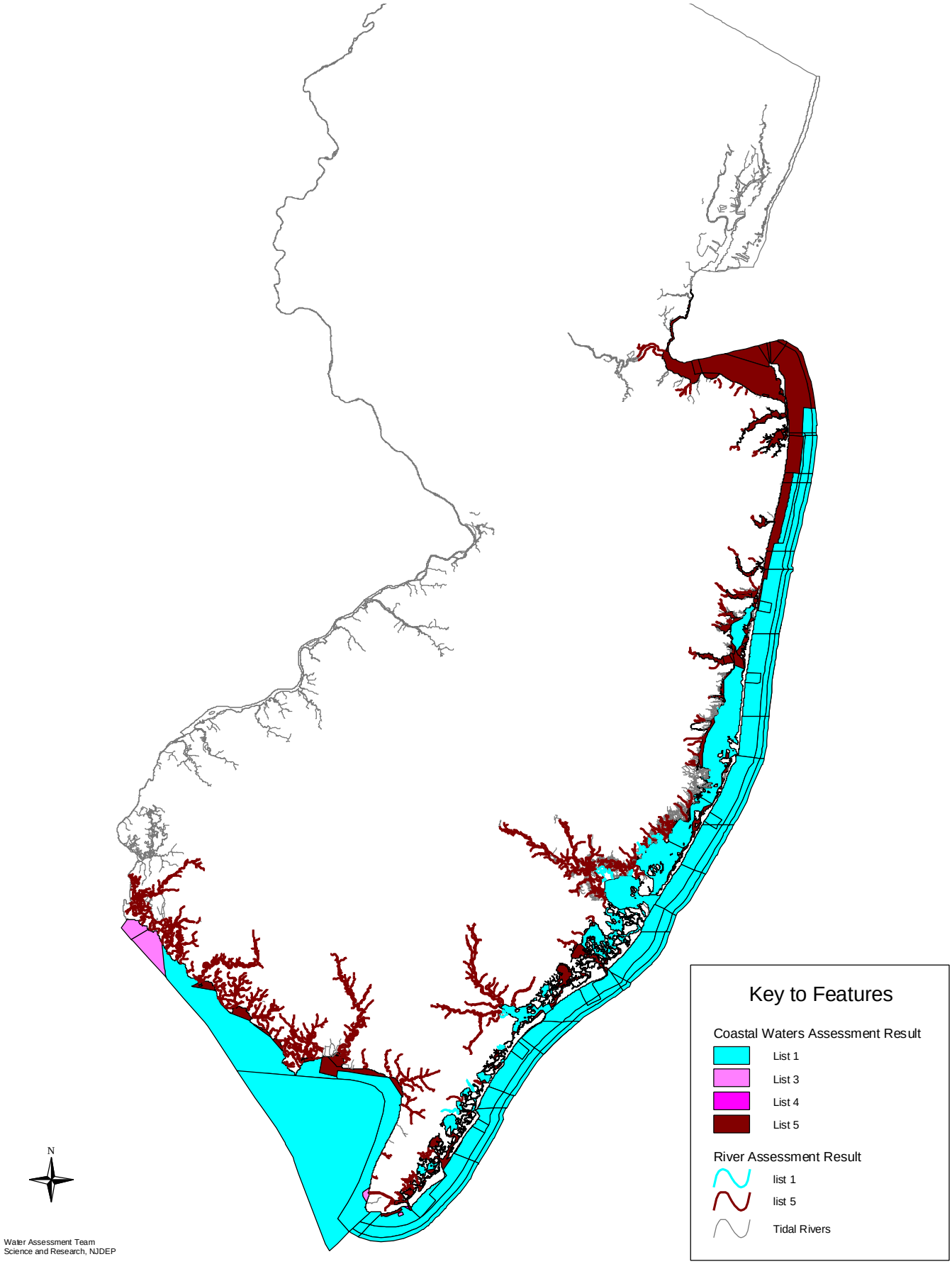
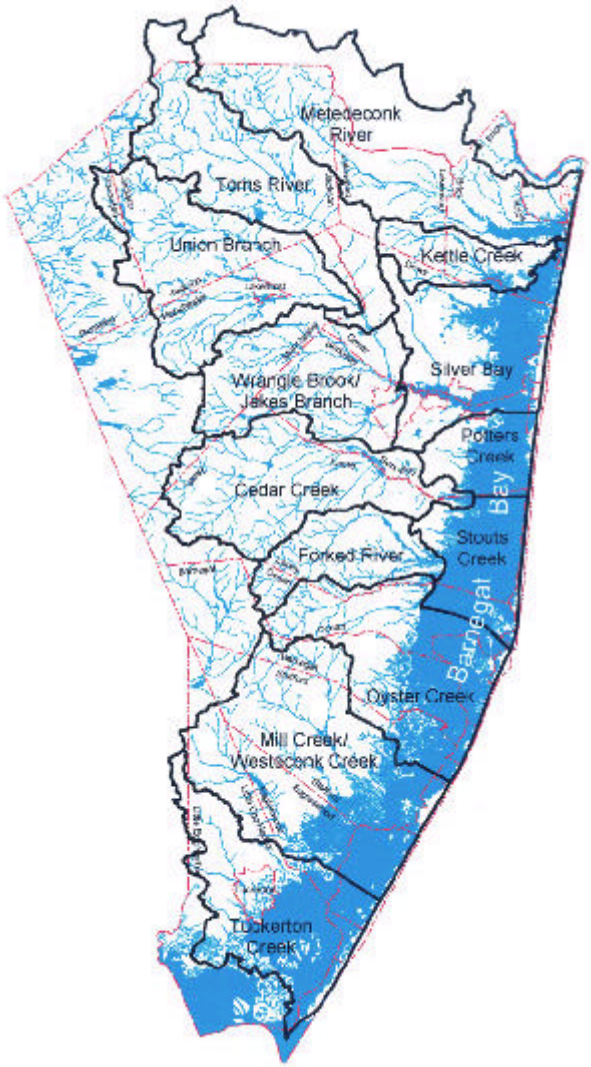


FIGURE 3.3c-2. Shellfish Assessment Status for Coastal Waters and Tidal Rivers.



Section 3.3d: The Barnegat Bay, Land Use and Water Quality

The Barnegat Bay – Little Egg Harbor Estuary and surrounding watershed encompasses most of the 33 municipalities in Ocean County as well as four municipalities in Monmouth County. Although long recognized for its important aesthetic, economic, and recreational value, this backbay system is now affected by an array of human impacts that potentially threaten its ecological integrity.



The Barnegat Bay Estuary is a 75-square-mile environmentally sensitive estuarine system, consisting of aquatic vegetation, shellfish beds, finfish habitats, waterfowl nesting grounds, and spectacular vistas. This 660-square-mile watershed is now home for approximately 500,000 people, a population which more than doubles during the summer season. Moreover, the entire watershed has undergone dramatic growth since 1950. During the 1990s, the municipalities surrounding the bay reported population expansions that on average exceeded 20 percent. The development accompanying the increasing population growth has resulted in land use changing from principally undeveloped and agricultural to suburban. Boat traffic, including personal watercraft, has also significantly grown on the bay, raising concerns with respect to both use conflicts and the cumulative impacts on the bay's water quality.

The magnitude and intensity of different land uses in the Barnegat Bay watershed are having significant, and often degrading, effects. Surface and groundwater quality in the watershed are being degraded by nonpoint sources of pollution. The relationship between land use and water quality and quantity has been clearly established. It is generally recognized that the increase in impervious surfaces associated with development exacerbates this situation by reducing the opportunities for infiltration of water into the ground. Development also impacts the estuary's fisheries and other biological resources through nonpoint source pollution and habitat loss.

It is the cumulative impacts of everyday activities in the Barnegat Bay watershed that are slowly degrading the environmental quality of this sensitive ecosystem. An assessment of the estuary indicates that human activities in the watershed and estuary have led to measurable degradation of water quality, destruction of natural habitats, and reduction of living resources in the system.

Section 3.3e: Harmful Algal Blooms

Planktonic single celled algae are abundant in the coastal waters of New Jersey. Concerns are sometimes raised when populations of some algal species grow very quickly and undergo a "bloom.". A bloom may accumulate into dense visible patches near the surface of the water or occur diffusely in the water column because of the density of concentration. When the algae subsequently die off and bring about depressed dissolved oxygen conditions, localized fish kills may result. A small number of species can also release toxic compounds to the water and cause mortality in fish, shellfish, render shellfish inedible and bring about bather discomfort and/or illness from inhalation of coastal water aerosols.

Of the many forms of algae present in New Jersey waters, two are currently of concern to the Department due to their potential to harm local fish, shellfish, and sea grass populations; one is *Aureococcus anophagefferens, a* minute (ca. 3 μm) pelogphycean brown alga, which is responsible for "brown tide blooms" that may be ecologically harmful but not harmful to human health; the other is the non-photosynthetic dinoflagellate *Pfiesteria*, which has negative impacts to fish health.

Blooms of the brown algae *Aureococcus anophagefferens,(* brown tide) have not been well documented in New Jersey waters. In 1995, a brown tide bloom was first documented in Barnegat Bay that was associated with the reduction in growth of juvenile hard clams, *Mercenaria mercenaria;* a severe bloom followed in 1999. Because of the limited information regarding the presence of this algae in New Jersey and the potential for further blooms, the Division of Science, Research and Technology within the DEP established the Brown Tide Assessment Project in 1999 to assess the spatial and temporal occurrences of the blooms and identify environmental factors that may promote, sustain, and/or terminate the blooms. Since the inception of the Project, significant blooms (e.g., Category 3 and Category 2) have recurred from 2000-2002 in southern Barnegat Bay and Little Egg Harbor. In addition, brown tide blooms have occurred in Raritan Bay, northern Barnegat Bay, Great Bay, Great Egg Harbor Bay, and other coastal bays in this area. Many of these blooms are at levels that in other states have been observed to bring about severe negative impacts to shellfish and sea grasses. The actual impacts here in New Jersey are unknown and studies of the impacts of these blooms on natural resources are needed.

The *Pfiesteria* dinoflagellate is currently the subject of much debate within scientific circles. These organisms can be free swimming in the water column and also remain dormant in bottom sediments in certain areas of marine estuaries (back bays and tidal tributaries). Of concern in New Jersey are two species, *Pfiesteria piscicida* and *Pfiesteria shumwayae*. *Pfiesteria* appears to be a natural part of the marine environment and under normal conditions is not a concern. However, some strains of *Pfiesteria*, under certain environmental conditions, are able to prey upon and kill fish and other marine animals by means of attaching themselves to the exterior of the host fish and becoming associated with severe epidermal lesions that eventually prove fatal to the host. These is also the possibility that *Pfiesteria* may induce fish-kills through the release of toxic chemicals into the surrounding water as well.

In response to these concerns the NJDEP's Division of Science, Research and Technology collected a series of water column and sediment samples from 35 estuary sites in NJ in 1999 and 2000 for evidence of *Pfiesteria piscicida*, *Pfiesteria shumwayae*, and *Cryptoperidiniopsis* (a close relative of *Pfiesteria*). Evidence of *Pfiesteria piscicida* was found in the Tuckahoe River in 1999, specifically at 3 sites near Corbin City. In addition, the Department has put into place a *Pfiesteria* Contingency Plan for New Jersey waters. The plan was developed by personnel from NJDEP and the NJ Department of Health and Senior Services and will be used by the two agencies to protect the public and state sampling personnel in the event that a fish kill occurs in which there is evidence that *Pfiesteria* may be involved.